PIANO TECHNICIANS
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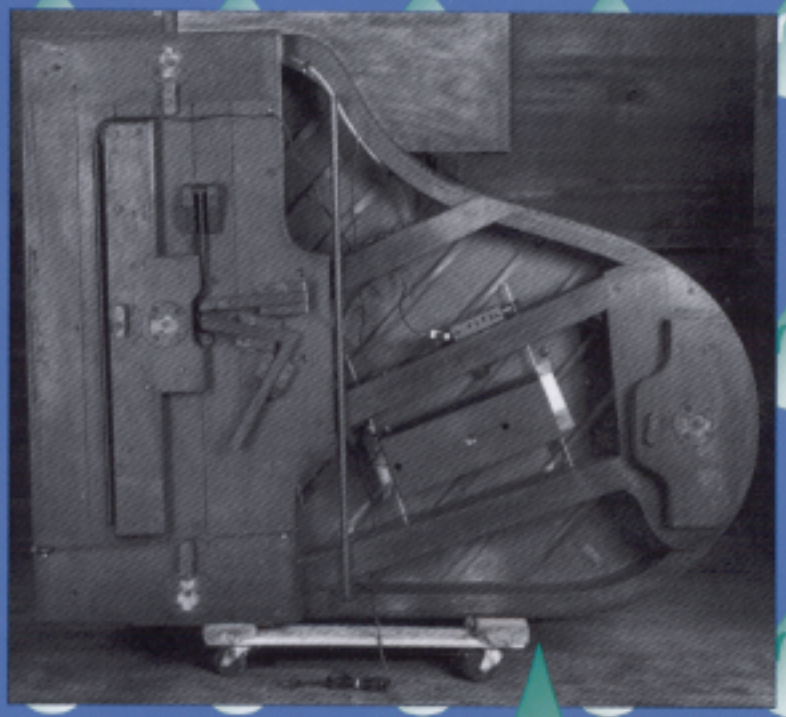

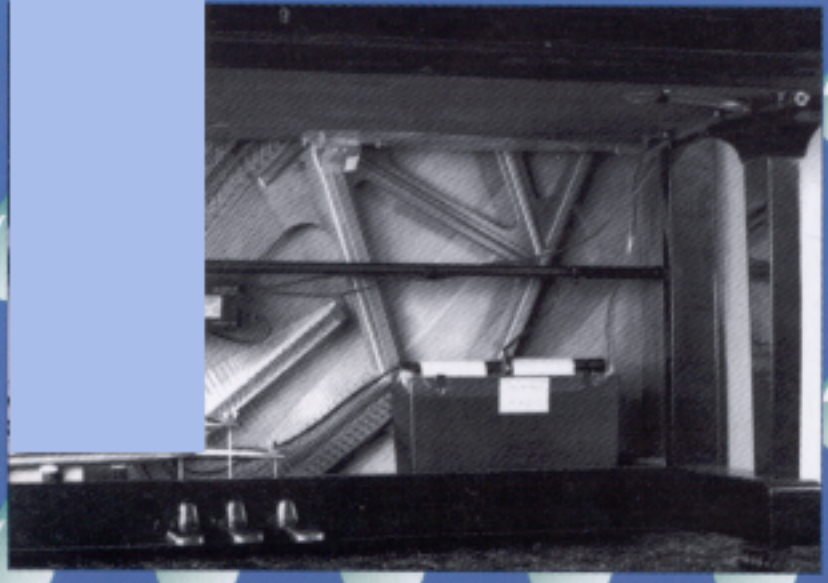

HUMIDITY CONTROL: THEORY & PRACTICE

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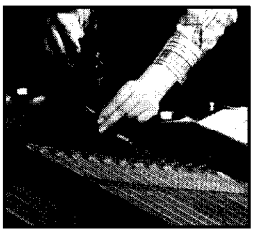
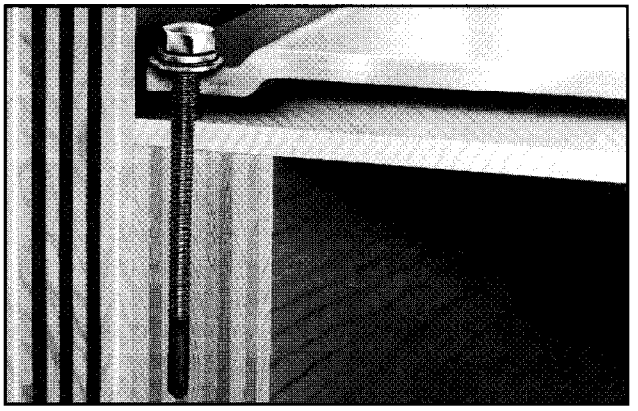


The precise setting of downbearing is critical for good piano tone. Too much bearing inhibits tone because the soundboard cannot vibrate freely, while too little bearing does not provide good sound transmission. From our research we have developed a unique method of setting downbearing with a degree of accuracy previously considered impossible.



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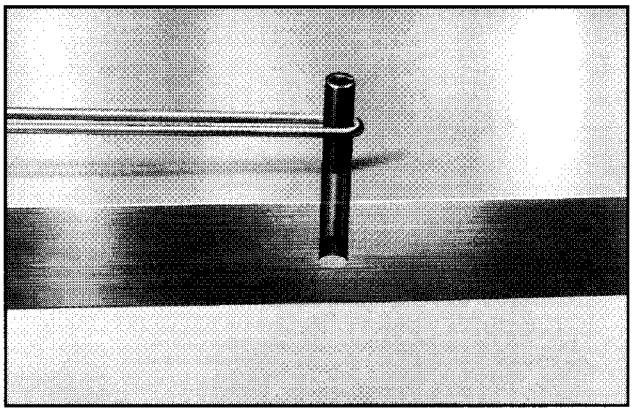

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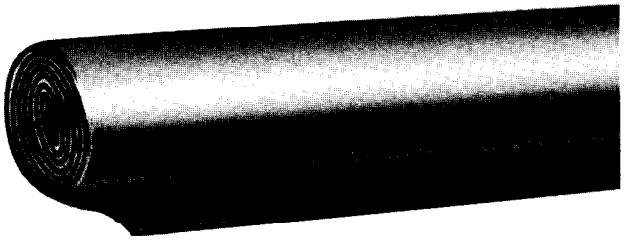

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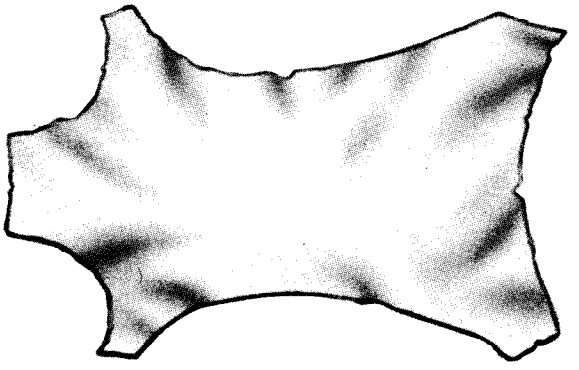

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PIANO TECHNICIANS
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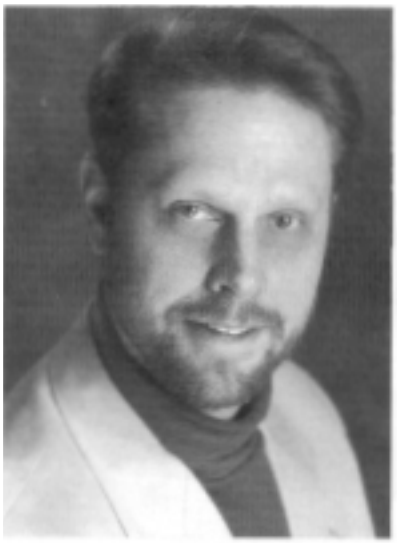
Editorial Perspective

Profession and Image

"But every profession has its hair shirt and its Chinese puzzles." —Balzac



Steve Brady, RPT
***Journal* Editor**

You may have had this experience: a client who hasn't seen you for awhile calls and asks, "Are you still tuning pianos?" You think, am I still tuning pianos? What is the implication of that question? Do they think this is just a hobby for me, or something I'm doing until I can get a "real" job? The more you ponder the question, "Are you still tuning pianos?" the more insulted you feel.

Or how about this one: Just after you've finished tuning a piano and collecting your fee, the client asks (in total sincerity) "So, what do you do for a living?" You stare — dumbfounded — at the questioner, not quite believing what you've just heard. Can this person really be that stupid? You swallow and take a deep breath before answering, "Well, I tune pianos." Why do many people seem to view our profession as somehow not really a profession?

The reasons for this perception about our work are numerous and likely not simple. But the perception is there, and it can be annoying. In this day of account executives (read: salespersons) and designer clothes with the labels on the *outside*, image seems to be everything. But is it really?

In the epigraph above, Balzac is speaking in the context of a discussion about the legal and clerical professions. But his point is that *every* profession has its irritations and its complex problems. Many of us wear the irritations of our job like a hair shirt, either developing calluses that deaden our response to the chafing (and impair our appreciation of pleasure as well), or allowing the constant abrasion to develop into a cancer. Some become obsessed with solving the puzzle of why these irritations exist.

To be successful in any profession, it's important to realize that we are not the only ones wearing hair shirts and struggling with seemingly insoluble mysteries. These things are part of each vocation. If we choose to make them the focus of our thoughts, we will suffer for it, because our thoughts will always become our reality. If we focus instead on the unique beauties and wonders of our work (and they are legion) our reality becomes beautiful and wonderful.

I read with interest recently about the importance of referring to an internal conception of what is satisfying and rewarding (self-referral), instead of reacting to external events and opinions (object referral). If I allow my emotions to be controlled by objects (delighted raves from a happy client, or being fired by a disgruntled one) I live on an emotional roller-coaster or, worse yet, I'm being played like a yo-yo. On the other hand, if my gratification is always based on reference to an

internal set of standards (like doing my best to improve each instrument) I can be fulfilled by my work regardless of the actions and opinions of others.

Perhaps this idea was best expressed by Schroeder, speaking to an incredulous Lucy.

Lucy: What happens if you practice for twenty years and then end up not being rich and famous?
Schroeder: The joy is in the playing.
Lucy: You've got to be kidding!

For us, the joy must be in the tuning.

PIANO TECHNICIANS
Journal
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COLUMNS & COMMENTS

DEPARTMENTS

IN ADDITION

FEATURES

PACE
Professionals Advance through Continuing Education
LESSON PLAN

Rose Silver, #9

The piano tuner spoke to me, he
who listens meekly to each note
and looks to the flats and sharps,
hearing and seeing something more remote.
And free from deception are his ears
and his hands, that in each chord awaken
those sounds happy to be dwelling together.

"My interest is in disinterest:
that I do not confuse music and instrument,
that I am simply the tuner of the piano—
This letter in our mundane tongue invites
a mere human to superhuman heights.
Oh! What new Physics in these dreams
for other ears, on other themes..."

Cecilia Meireles (Brazilian, 1901-1964)

COVER ART

The topic is humidity — how to control it, and why. Beginning on page 22, we'll take a look at the products that are available and the proper ways to use them.

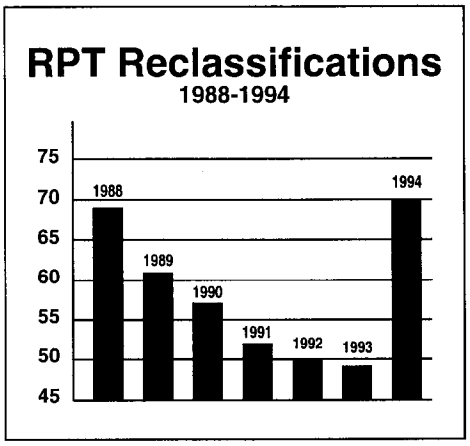
Encouraging Reclassification

Test: to prove the genuineness by some fixed principle or standard. **Examine**: To inquire into the qualifications, capabilities, knowledge, or progress of... *as, to examine a candidate for a degree.* **RPT Exams**: A series of exams given to Associate PTG members to assess their qualifications, capabilities, knowledge, and skill on the maintenance, repair, and tuning of pianos.

PTG President
Leon Speir, RPT

Examinations have been a significant part of the Piano Technicians Guild since its formation in 1958. Today, an *Associate* PTG member must take and pass a series of minimum skills exams to become a *Registered Piano Technician (RPT).* Certification programs for a trade and trade organizations are not unique to the PTG. **Music Teachers National Association (MTNA)** provides an opportunity for its members to participate in a certification program to establish standards of excellence for the music teaching profession. Approximately 18% of MTNA's total membership has elected to participate in the MTNA National Certification Program. The Piano Technicians Guild, on the other hand, has over 58% of its members who have taken and passed the series of RPT exams it offers. When making a comparison to MTNA, the total number of PTG members who participate in a certification program appears impressive; however PTG traditionally has been an organization of Registered or certified technicians. MTNA began its certification program as an added option.

From 1988 until 1993 the trend has been that fewer Associate members each year have reclassified to RPT membership. The following graph clearly illustrates the declining number.



In the five years from 1988 until 1993, there was a 29 percent decrease in the total number of Associate reclassifications. The total reclassifications in 1988 were 69 and in 1993 there were 49. 1991, 1992, and 1993 show a slight leveling of the decline and in 1994 the number of reclassifications rose dramatically to a total of 70. 1994 represents an increase of 56% in one year!

Clearly, recent progress has been made to reverse the declining numbers of Associates who successfully complete the exam process. The **PACE Lesson Series** in the *Journal* and the **Exam Study Guides** provide Associates with the needed tools to encourage participation in the RPT exams.

PTG must continue to evaluate and refine the entire exam process. This year the ETS Committee has proposed a bylaws amendment to help streamline the exam for those who use electronic equipment. By changing the order of administering the aural portion of the exam, time savings are realized for both the examiners and those that are tested. Also a pre-screening manual has recently been written by **ETSC Chair Mitch Kiel**. This well-written manual received a trial run at the California State Seminar in February. Pre-screening will help save time for both the testing personnel and the person being examined by helping to identify whether an applicant is ready to take the exams.

A concerted effort has been underway for the past three years to develop policies and tools to encourage re-classification. Many Associate members currently possess the needed skills to become RPT members. PTG must insure that it continues to provide educational tools, the testing personnel, and available test sites. Additionally, continuing evaluation of the exam and the exam process will insure efficiency in the testing program. Testing is a major part of PTG; we must make it as good as it can be.

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Letters

Storage of tuning curves

I've been catching up on my reading, and got to the article by Kent Swafford "Frequently-Asked Accu-Tuner Questions" (August 1994, page 25ff.).

In the introduction in italics the statement is made that the SAT is absolutely unique on the market in that it's the only electronic visual tuning aid that can store tuning curves.

This statement is incorrect. The Yamaha PT-100 visual tuning aid, in addition to a number of pre-programmed tuning curves for uprights of various heights and grands of various lengths, plus a curve for electric pianos, plus it can be switched over to the meantone or Werckmeister III temperament, also has the ability to store tuning curves if the user wishes to do his/her own programming. The unit can also be attached to a printer and the curves can be printed out. It has a cent scale to tenths of a cent, in increments of 0.2¢. It seems to have a built-in bandpass filter. I notice (as a factory chipper and sometimes first tuner) that it's largely insensitive to background noise, and it will clearly display individual upper partials. That would indicate a built-in bandpass filter.

The measuring range is from A37 to C#89 (i.e. half a tone above the top note of the piano). The notes below A37 are tuned according to upper partials, so that the tuning curve in the bass results automatically.

The shortest upright scale in the pre-programmed curves is 110cm (about 43"), so if you need a curve for a 36" spinet, you have to program it yourself. This is no problem in Europe. I've never seen a 36" spinet or 38" console here. The smallest Schimmel upright is 100cm (about 39"), a leftover from the 1930s when small pianos were very "in." We make very few of them, and I've heard talk of phasing it out. Our most popular upright models are 112cm (44") and 118cm (46 1/2"), and we also have a 130cm model (51"). So the tuning curves for 110cm, 120cm, and 130cm in the Yamaha tuner suffice for chipping and first tuning in our production. In our factory, electronic tuning aids are allowed, and the company will even provide a tuner with a Yamaha PT-100 if he wishes. The other second chipper and I both use the Yamaha device; the tuners who come after us prefer to tune by ear. The tuners seem to be happy with the chippings; I practically never get complaints.

One time in a book on tuning the question was asked, "Who do we tune for anyway? Other tuners?" I'm in an unusual position. I *do* tune for other tuners. The customers who buy the pianos never get to hear my work.

J. Engelhardt,
Federal Republic of Germany

Kent Swafford replies:

Mr. Engelhardt is of course technically correct that the SAT is not the only device that can store custom tuning data. What I should have emphasized was the SAT's ability to simultaneously store the data from 10 to 206 tunings, and the SAT's ability to recall, ready for use at any time within a few seconds, any one of those sets of data from the "pages" of the SAT's own internal memory. (One of my SATs can actually store 208 tunings, if you count the SUP and EEE pages that are associated with the function that scores the PTG tuning exam.)

Whatever happened to 'art?'

For many years I have wanted to write to the *Journal* on this subject. The article in the December issue by Daniel Levitan on "The Math Of It All" makes it imperative that I express my thoughts.

The "art" I refer to is not a person but the artistry of piano tuning. All books on the subject of tuning agree and define tuning as an art. One dictionary states it this way, "The skillful and systematic arrangement or adaptation of means for the attainment of some end. Artistic mastery or skill."

The admonition "Piano tuning is a subjective art rather than a mathematical absolute" is as true today as when first stated at a PTG institute many years ago. As a charter member of PTG I know the value of membership, attending the conferences, and the educational opportunities of PTG. I shudder to think where I would be had it not been for the influence of those members of The American Society of Piano Technicians, which I joined in 1946. Education and knowledge is essential to advancement and growth. The memory of my first convention in 1947 in Detroit convinced me everlastingly of the value of membership. Men with names like Gose, Hoskins, Stein, Kingsbury, Stonaker, Davis, et al, with gray hair and no hair, ready, willing and eager to help a 28-year-old fledgling.

I was privileged to live through the Stroboconn era with Dr. Earle Kent, ably assisted by Jim Coleman, demonstrating many times at conventions. I was never convinced to part with the $1,200 cost even at the urging of friend Paul Kegley. It boasted of "unfailing accuracy to 1/100 of a semitone." Now, we have advanced to the computer era where the accuracy of the Accu-Tuner is 1/1000 of a semitone. If I was 50 years younger I'd probably have one. As long as I have discriminating customers call to retune their pianos after having those who use electronic devices, I'll be content with artistic ear tuning. Incidentally, I took the tuning test until I scored over 90.

I view piano tuning as the ultimate artistic performance just as a musical concert, be it solo or symphony orchestra. They must be seen as well as heard without benefit of electronic enhancement. There is a certain pervading spirit of freedom to be able to satisfy discriminating musicians

Continued on page 20

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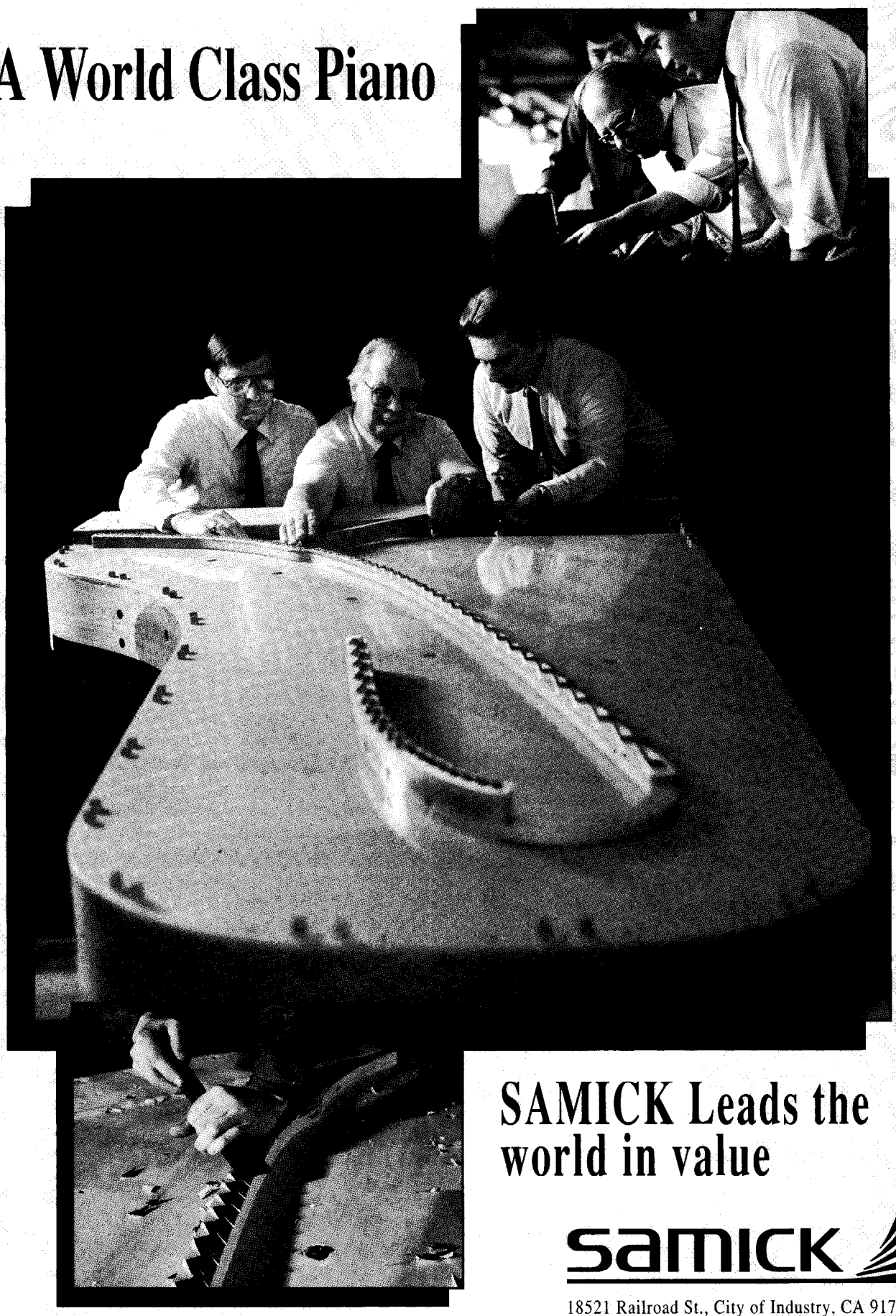

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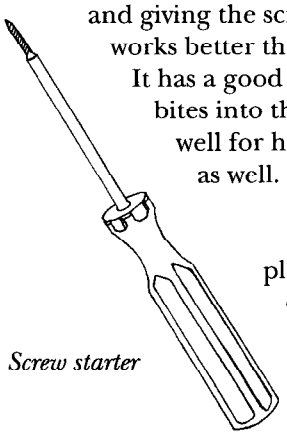
TT&T

Starting Screws and Plugging Screw Holes
From Isaac Sadigursky, RPT:

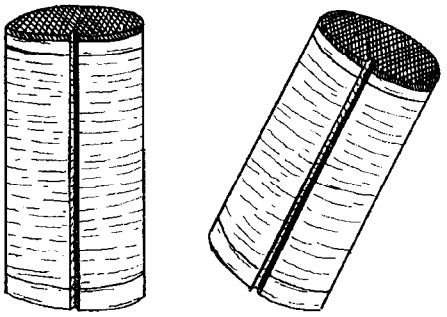
Here is a new tool ("Screw Starter" from Stanley Tool Company) which I've found very useful in my everyday service calls. When filling a stripped screw hole and giving the screw a new start, this tool works better than anything I've used before. It has a good grip, it's small in size, and it bites into the wood nicely. It works very well for humidity-control installations as well.



Screw starter

Also, a bit of info on wood plugging: It's been noted that one of the favorite materials for plugging stripped screw holes is... toothpicks! Most of our fellow technicians are former musicians; very few are familiar with woodworking techniques. Toothpicks are a poor choice for this application because toothpicks are treated with wax(!!!) to protect consumers' teeth. Wax will prevent the wood of the toothpick from absorbing the glue. There was an almost scandalous story of the pedal lyre falling off a piano at the Hollywood Bowl. A piano technician had attached it with screws, "plugging" the holes with toothpicks! The best plugging material for stripped screw holes—especially for larger holes and shop jobs—is hardwood plugs (not dowels), cut with a plug cutter (available at woodworking supply stores) on a drill press. These plugs have the grain running horizontally, similar to the grain in the piece being plugged. Falconwood is especially nice for this. Put a shallow vertical saw kerf into the side of each plug to allow for glue to escape, then drill out the hole you're plugging to fit the plug. Glue in the plug, wait for the glue to dry, then drill a new pilot hole in the plug. For smaller jobs in the field, shoe pegs work fine (available from APSCO, Cat. #511723).

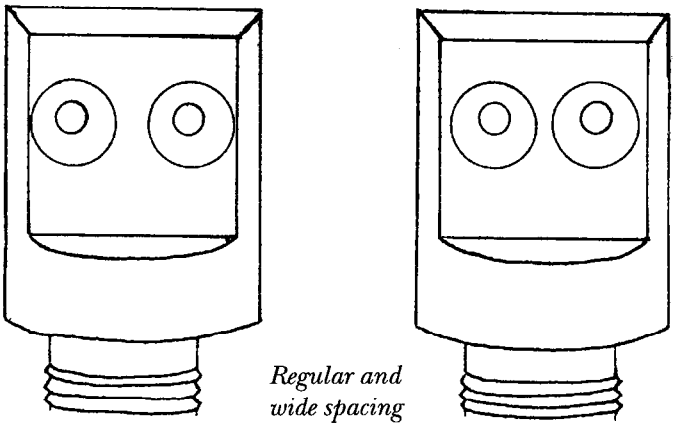
Hardwood plugs



TT&T

Wide-Hole Agraffes
From Isaac Sadigursky, RPT:

On smaller Steinway grands (S, M, L) the lowest four bichord notes should have *wide-hole* agraffes. These special agraffes, available from Steinway, separate the strings, allowing the damper heads to sit at a more even height.



Regular and wide spacing

TT&T

Clean Steel Wool Before Use
From Bob Waltrip:

Steel wool is impregnated with oil, so that it doesn't rust in the store. Before using steel wool to clean or polish piano parts, it's a good idea to wash the oil out of it; otherwise, an oily residue will be left on the piano parts.

Put your steel wool into a quart-sized jar, fill the jar half full with acetone, put a lid on it, and shake vigorously. Remove the steel wool and shake it out, then let it dry in the open air.

TT&T

Glue Applicator for Hammershanks
From Steve Brady, RPT:

I came across this tool during a recent trip to Arizona. It is made of 3/8" diameter Delrin rod, with holes drilled into each end. The tool is dipped into the glue, then placed over the end of the hammershank, leaving an even coating of

Continued on page 12

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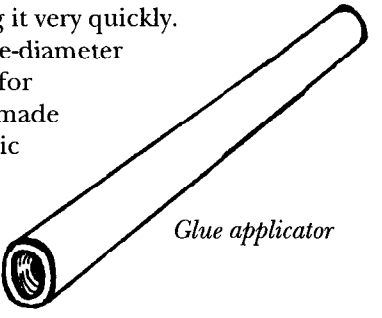
glue on the shank, and doing it very quickly. One end accommodates large-diameter shanks, and the other end is for smaller shanks. Because it is made of Delrin (a low-friction plastic similar to Teflon) the glue doesn't stick to the tool, so clean-up is easy. This tool is available from Jim Coleman, Jr., 602-966-4055, for $4.00 plus shipping & handling.



Glue applicator

Contour & Padding for Tuning Hammer
From Mitch Kiel, RPT

About six months ago, I wrapped bicycle handlebar tape onto both my Hale tuning hammer and my Mehaffey impact hammer. I think it's a wonderful improvement. The bike tape provides great shock absorption and improved traction (sounds like a car commercial). It also soaks up perspiration, a real benefit for a sweat hog like me.

Here's how I did it:

I bought bicycle handlebar tape with the most padding I could find. I think it was called "Chunky Tape" and cost about $12. It comes in all kinds of groovy colors and wild patterns; I used black.

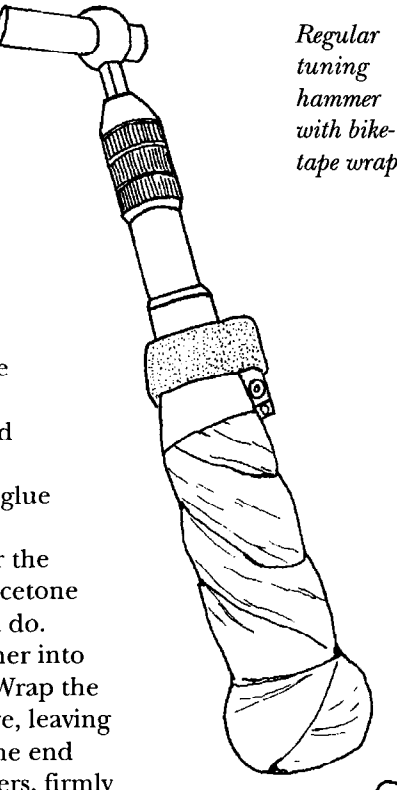
For my wooden-handled Hale hammer, I used one entire length of tape, leaving exposed 1 1/2" of wooden handle at the tip end, where I've attached a 1" band of self-adhesive strip of fuzzy velcro for my Reyburn SAT thumbswitch. (I attached small strips of fuzzy velcro to the sides of the thumbswitch to improve contact with the 5" velcro hook strip that comes with it.) At the other end of the hammer, I wrapped the bike tape to create a ball-like bulge 2" in diameter.

I used the second strip of bike tape on my impact hammer, which I employ for tuning all verticals. It's a Mehaffey impact hammer with a 3/8" steel shaft about 8" long.

Starting at the tip, I wrapped the bike tape onto five inches of the steel shaft, leaving three inches unwrapped. I wrapped the tape to create a pear-shaped bulge about 1 3/4" fat and 3" long, that fits my palm perfectly. Over the bike tape (near the weight) I put a band of self-adhesive fuzzy velcro to attach the Reyburn SAT thumbswitch.

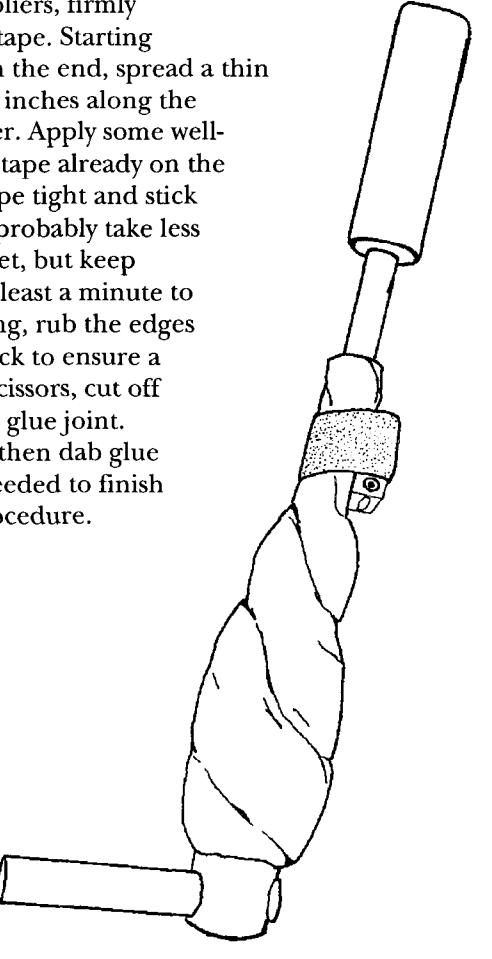
The bike tape, being self-adhesive, sticks OK when you start winding it. But it needs a little cyanoacrylate glue (super glue) to keep the end from unraveling. Here's my procedure:

- As always, use only fresh CA glue.
- The CA glue absolutely loves the bike tape and will bond instantly; you'll only get one chance at attachment.
- Don't oversoak the tape with glue, or you'll create a hard spot.
- And please, don't glue your hand to the tuning hammer or the tape. Have some acetone nearby in case you do.



Regular tuning hammer with bike-tape wrap

Clamp your hammer into a padded bench vise. Wrap the tape as described above, leaving about four inches of the end free. With vise-grip pliers, firmly grab the end of the tape. Starting about one inch from the end, spread a thin layer of CA glue two inches along the inside of the hammer. Apply some well-targeted glue to the tape already on the hammer. Pull the tape tight and stick it. The CA glue will probably take less than 10 seconds to set, but keep pressure on it for at least a minute to be sure. While waiting, rub the edges of the tape with a stick to ensure a bond. Then, using scissors, cut off the tape close to the glue joint. Round the corners, then dab glue under the tape as needed to finish your attachment procedure.



Impact tuning hammer with bike-tape wrap

Q

Protecting your hearing

I have been tuning pianos for nearly 39 years now, and I am starting to experience some ear problems in the form of a "hissing" or "ringing" in the ears, much like the sensation you might have after attending a concert of very loud music. Most likely rock music. The problem is, it does not go away by the next morning!

I have had my hearing checked with an ear specialist, and he says it is as good as it was when he tested it 18 years ago.

I did buy some hearing protectors at a PTG Convention some time ago. They are the Sonic II made by North Consumer Products in Cerritos, CA.

I find the Sonic II work fairly well on loud grand pianos, but I would like to know if other tuners are doing anything to protect their hearing and if so, is there a better system than the one I describe.

Perhaps there has been an article about hearing protection in past years, but I have not seen it.

I would like to hear some opinions from other technicians.

Cliff Brownlee, RPT

A

From Joe Garrett, RPT

Joe Garrett has worked for several years in the medical field and has also tuned pianos for over 20 years. He wears hearing aids.

Although a few articles regarding hearing have appeared in the *Journal* over the years, we need to be even more concerned and informed. You have been tuning for 39 years. This in itself is enough to make you have a hearing problem. The average decibel level while we are tuning is 85-90 db. The period of time it takes to tune the average piano is one to two hours. You should rest your ears at least 15 minutes for every hour of tuning. Knowing that this is not always possible, we do damage to our ears. This damage is irreversible! We can, however, resort to hearing aids, after the damage is done. And with today's technology we can lessen the trauma in the future. The "Sonic II" hearing protectors are probably an adequate answer to loud concerts, but they are not the answer to *our* problem. The best hearing protection can be obtained from a Certified Hearing Aid Dispenser. These are custom fitted to your ear canals and, if the C.H.A.D. is competent, that person will or should have an in-depth discussion with you about your special needs. We are a very special part of the service force, in that we make our living with our ears.

The "hissing" and "ringing" that you describe is called *tinnitus*. This phenomenon is a *warning*. If you experience tinnitus, you may have subjected your auditory system to too much sound pressure (i.e., decibels). Other causes of tinnitus include ear infections, aspirin and "miacin" antibiotics.

You stated that the last time you had your hearing checked it was by the same "Ear Specialist" that checked you 18 years ago! We should have our ears and hearing checked at least once a year. For the regular person, every other year is adequate, but for us — *once a year*! Also, there are new inroads and advancements being made almost on a daily basis. I suspect that your ear specialist may not be able to keep up with it. The cardinal rule regarding medical decisions is: always get a second opinion. An Audiologist should be the first professional person to contact about a hearing problem. Once the Audiologist has ruled out any physical problems, etc., then make a trip to the Certified Hearing Aid Dispenser.

One final note to all tuners: if you are doing more than 3-4 pianos a day, you are working too hard for too little. My advice is to slow down, charge more, and be happier. If anyone would like to have specific questions on this subject answered, let your fingers do the walking through the Guild directory. I'm available.

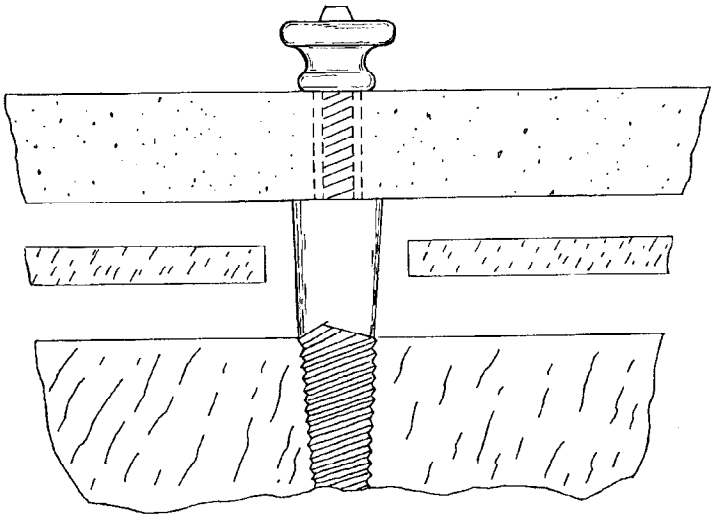
Q

Avoiding teeth marks

I wonder what tricks have been devised in the removal/replacement (with the original, as opposed to replacing new) of the shoulder nut that doesn't have square sides (the one that's typically in the center of the elongated "X" at the rear left of the plate). I've never been able to get that thing off without munging the finish and/or leaving "teeth marks" (from the vise-grips, not my own teeth!). I've seen where other rebuilders have gone ahead and munged the thing up, then turned it back smooth on a grinder (not particularly elegant-looking!). Is there some kind of tool—not unlike an oil filter wrench—that one can make or buy that will do this task with elegant results?

Ron Torrella, RPT

[Editor's note: This question, and the answers that follow, were taken from the Internet discussion group, Pianotech]



A *From Conrad Hoffsommer, RPT*

Try taking the felt off an old bass hammer (or tenor size), carve it down to size and use your pliers (channel-lock?) around that. The felt should be tough enough to grab the nut, but not allow the teeth to get through.

A *From Mark Story, RPT*

I just wrap a strip of leather around the nut before I attack it with the vise-grips or channel-lock pliers. It's not foolproof, but it helps. Let's face it: we're trying to unscrew a tight, soft piece of metal with a hard steel tool and lots of force. I think the only way to restore it to pristine condition would be to replace it, if that's possible.

A *From Ken Sloane, RPT*

I've never tried it, but Bob Russell once told me long ago that Vise Grip pliers with some sort of plastic jaws (I saw a pair once, and I believe the jaws were orange-colored) work just fine.

A *From Bill Ballard, RPT*

How about a hose clamp? I only just now thought of it, and haven't tried it. I was down to grabbing the cap nut with a pair of needle-nose vise grips, at the waist, where it wouldn't be visible. Whenever I tried to put cow hide between the jaws and the nut, the serration of the jaws just bit through the hide. The slots in the hose clamp band would get a slight bite into the nut, and the pinion bolt assembly would give you plenty to grab with. Try it, but don't sue me...

A *From Ron Torrella, RPT:*

Well, finally, I got a nice, hand-sized piece of rubber—1/8" thick, like what you find on piano dollies— and held the nut in place (bare-handed) while I turned the shoulder-bolt down ever-so-slightly. Worked like a charm. Same idea as what they use to open stubborn jar lids, which is where I got the idea.

[Editor's note: It looks like Ron ended up answering his own question! Was this a setup, Ron?]

Q **Perceived loss of power**

I recently resurfaced the hammers, regulated, and voiced an upright piano for a piano teacher and player of artist type ability. Initially the hammers were very cupped and it was necessary to remove a considerable amount of felt to restore them to an acceptable shape. Hammer replacement would have been more appropriate, but he lacked the finances to do so. The original hammer blow was excessive (about 2 1/8"), as was the key dip (about 7/16" or more). During regulation I set key dip to 3/8" and hammer blow to about 1 7/8". I was quite pleased with the final results of everything, but my client complained of what he perceived to be a "lack of power" of the piano compared to its original condition, and he reasoned that this was so because of moving the hammers closer to the strings and thusly reducing the inertia and power with which they struck the strings.

So my question is: does a piano regulated with excessive blow distance and key dip develop more power than one regulated to more traditional specifications? If this is true, I'm sure it's at the expense of repetition speed, and I'm also sure that the reduced weight of the hammers from the hammer resurfacing also figures in, but to what degree? Could someone please discuss this entire matter?

Terry Rood, RPT
Montague, CA

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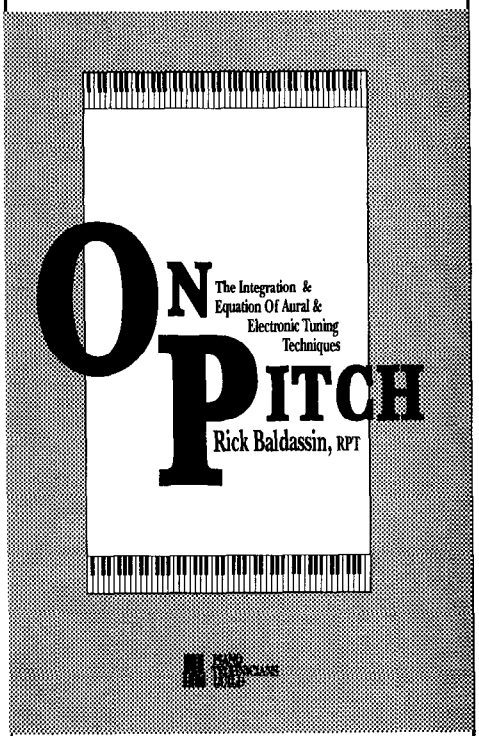

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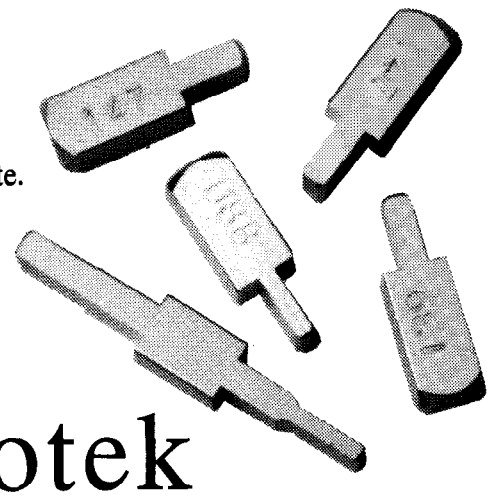

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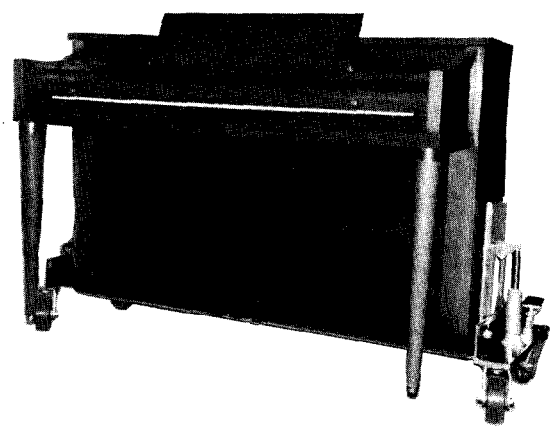

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A: Ask The Right Questions

By Ken Sloane, RPT

Your experience, Terry, is an interesting one, with your client's perceived loss of power in his piano attributable to any one or combination of several factors. First, let me make the hypothesis that a pianist gets more power from a note by accelerating the note faster so that the hammer strikes the string at a higher speed or rate of acceleration. To coin a phrase, you might say that he/she (the pianist) has given the hammer a higher "string contact force." It's a complex problem involving many variables to analyze what contributes to the string contact force (I hope you don't mind my coining the phrase), but acceleration of the hammer is very important. With that in mind, let's look at your questions by starting there.*

You commented that your client attributed this loss in power to your moving the hammers closer to the strings, "thusly reducing the inertia and power with which they struck the strings." First of all, the inertia level in an action is a function of the dimensions and mass of the components that make up all the levers. Reducing the hammer blow does not change any of this and, therefore, does not change the inertia level in any note. Be advised, however, that when the inertia in a note is actually changed, it certainly affects the ability of a pianist to accelerate that note; but I'll talk more about that later. Here are some more questions to ask:

Would moving the rest position of the hammer closer to the string change how gravity affects the ability of a pianist to accelerate a hammer or, to coin another phrase, change the "acceleration potential" of the piano? As for gravity, the hammer in an upright is so close to vertical that I don't think it need be considered. Besides, you set the rest position of the hammers in your client's piano closer to the strings, making the hammer more vertical; so if gravity affected the acceleration potential of the hammers at all, your reducing the hammer blow would have increased the potential, giving him *more* power. Your client, as you told us, perceived less.

Another logical question to ask is whether hammers in a piano accelerate over their entire arc of movement? If so, one could assume that raising the rest rail would reduce a piano's acceleration potential. Associated with raising the rail is a regulation process, and we need to ask how parts of that regulation process, like taking out the loss motion, resetting the point at which the spoon contacts the damper lever, etc., affects the acceleration potential. When asking myself these questions, I decided the time had come to locate a vertical piano and try some things. I searched out an old but seldom-used Everett 11 (45" vertical) that was in good condition and regulation. It had a blow distance around 1 13/16", dip of 3/8", and a soft pedal that was regulated to reduce the hammer blow to 15/16" (about half).

Now I came to this piano knowing that a friend of mine (Michael Wathen, Technician at Cincinnati Conservatory of Music) had looked at the acceleration rates of hammers in some grand pianos he services. I will not get into any of the theory or conjecture he passed on to me as to why the following happens, but Michael discovered (and he used sophisticated instruments to make his measurements) that a grand hammer accelerates over approximately the first half of its travel and decelerates over approximately the second half. I was wondering if an upright displayed this phenomenon also; and even though my experimentation was not very scientific, I found some things revealing in that regard and also pertinent to Terry's questions. They follow:

With the soft pedal on my Everett engaged, no matter how hard I tried, there was no way I could play as loud as with it unengaged; yet the pedal did not appear to be incremental in its effectiveness. At the beginning of its movement and with small increments of change thereafter, not much change in volume occurred until, rather suddenly, when depressed nearly all the way down, the volume level of the piano diminished significantly. Two factors are likely involved here. The hammer spring is starting to exert some significant pressure against the butt at this point — its force against the butt is a linear progression, adding a constant change in force with each increment of change — and the damper spoon is very close to its contact with the damper lever. I theorized that the energy required to overcome the force of these two springs — especially with the force of the hammer spring being at a higher level than with the soft pedal unengaged — could possibly diminish the acceleration potential and contribute to the soft pedal's effectiveness. I'm

---

** One of the technicians who works with me at Oberlin Conservatory is a graduate in physics from Oberlin. In regard to motion of the hammer, he contends that the speed of the hammer at contact with the string is the critical component. It doesn't matter if the hammer is accelerating, at constant speed, or decelerating when it hits the string.*

quite sure the reduced distance available to the hammers for acceleration in the soft pedal mode affects the strike contact force and also adds to the soft pedal's effectiveness, but I wonder how much? To support my "hypothesis" about the springs, I disconnected some hammer springs from selected notes on my Everett (I did not fuss with damper lever springs because of the damping problems it would cause) and played chords composed of notes with and without hammer springs working. With the chords that had the hammer springs disconnected, it was harder to play soft and the soft pedal was not as effective as on chords with functioning hammer springs.

What about the lost motion the soft pedal introduces into the action (except for those old Wessel, Nickel, and Gross upright actions with the attachment that eliminates excessive lost motion when lifting the hammer rail — ah, those were the good old days)? I engaged the soft pedal on my Everett and adjusted the lost motion out of several notes that composed a chord. With the soft pedal engaged, I compared them to chords composed of notes I had not adjusted. The chords with the lost motion adjusted out diminished the volume significantly but not as much as those with the lost motion present. This showed that a definite acceleration potential existed between the two and indicated that lost motion contributes to the effectiveness of the soft pedal. I would characterize the difference as small, however, certainly when compared with the change that engaging the soft pedal makes for both.

So how does all this relate to Terry's piano? In regard to his question that asks about the possibility of excessive key dip and blow distance contributing to more power, I sort of doubt it. Be reminded regarding my Everett that small increments in depression of the pedal when moving the rail from "full-blow" position did little to produce any significant

> *"Hammers unmated to strings produce a muted tone, often of poor quality."*

changes. Also, my personal experience indicates that when I have changed the blow distance on pianos either way (grands and uprights) to accommodate dip, I don't get comments about changes in power. And about Terry's question that asks if excessive dip and blow distance cause repetition to suffer: Certainly with excessive movement of action parts, the recycling process necessary for repetition to occur will take longer. Whether or not it's going to detract sufficiently from repetition to actually slow a pianist down is another question, but it certainly should not be ruled out. Another thing to consider is that excessive dip and blow distance can make a piano feel "unwieldy" (more finger movement to cope with) and give the perception to the pianist of a heavy action that makes powerful playing more difficult. But as all of us who service pianos frequently for serious players well know, many of these regulation quirks become more or less relevant in individual situations due to the personal preference factor of the pianist. Don't ever underestimate it!

About Terry's question regarding the resurfacing of the hammer and how it figures into the perceived loss in power: Assume we have a piano with a "working" regulation. Now if a pianist comments about that piano being either underpowered or too hard to play soft — let's call the latter a piano with *too much* power — I feel the pianist is referring to problems in the piano associated with friction, inertia, hammer shape/density/weight, or a combination of the three. If such is the case, and the piano is really not in bad regulation, using different regulation alternatives may provide an artistic tool which the pianist can use to extract slight nuances in tonal color and dynamic range from the instrument; but to get more or less power...I doubt it. What probably happened to cause Terry's client's perception is associated with the hammer filing. Some things to consider are:

Filing hammers excessively decreases their weight and gives an action a lighter feel because inertia is reduced and hammers become easier to accelerate. However, a lighter hammer imparts a different tone to a note, and the merits of using a lighter hammer over a heavier one is the kind of thing that could be discussed ad nauseam. Some would argue that a lighter hammer, especially if it is firm, will produce a brighter sound while a heavier hammer will produce a fuller or rounder tone that projects well. And which is louder? People would argue that issue also, with the brighter sound probably getting the nod for loudness more so than the rounder. So how can Terry's client's piano — since Terry filed the hammers, made them easier to accelerate, and possibly brighter in the process — have less power?

My suspicion (we're honing in) goes back to Terry's comment about the hammers in his client's piano being very cupped prior to his filing them. I associate cupped hammers with a manufacturing process that uses a firm felt glued to a hammer core under considerable tension. These hammers are usually quite hard and, in their cupped state, produce a tone that is harsh and glassy. After Terry filed the hammers, I wonder if he had time to carefully mate the hammers to the strings. I am always surprised, especially with firm hammers, how critical this is

to getting maximum tonal projection from a note. Hammers unmated to strings produce a muted tone, often of poor quality. I suspect that the unmated condition produces a small amount of wobble as the hammer strikes the strings, and this wobble or deflection seriously affects the ability of the hammer to reach its optimum string contact force. The resultant, muted sound is frequently characterized as being weak, with little projection.

And besides, even if Terry had the time to mate hammers carefully to strings after filing, the newly shaped surface of the hammer would have produced a less harsh tone that his client could easily have perceived as having less attack sound or volume. I wonder if his client liked the tone of the newly surfaced hammers, even though he considered the action to have less power?

In closing, I hope I have provided Terry with some answers to his questions. They are questions that pertain to very subjective topics, the discussion of which involve controversial thoughts and ideas. I encourage anyone else who reads this to provide some feedback to Terry and other readers interested in his questions. Does someone want to talk about friction and power or more about the effect of inertia? Hope to hear from you soon.

Letters

Continued from page 8

completely on your own, independent of the use of the word inharmonicity and seven pages of mathematical tables. I have the urge to yell, "Enough! Enough!"

Clayton Harmon

Daniel Levitan replies:

Mr. Harmon makes an excellent point in his letter that "piano tuning is a subjective art rather than a mathematical absolute." In this he and I are in complete agreement, as my article in this issue (which, by the way, was in my editor's hands before I received Mr. Harmon's letter) should make clear.

It's also clear from Mr. Harmon's letter that he is convinced that a fine aural tuning is usually to be preferred to a tuning done solely by reference to an electronic tuning device. I believe that this is the overwhelmingly prevailing view in our profession. It's certainly a view that I share, and I believe it is also shared by Dr. Sanderson, the developer of probably the most advanced tuning device available, the Accu-Tuner, of which Mr. Harmon makes mention.

I think that Mr. Harmon would agree with me that anyone who seeks to master an art must strive to have as full a grasp as possible of the materials that pertain to that art. I doubt that he would consider a musician with a rudimentary grasp of the laws of harmony to be a master in the art of music. Similarly, I don't believe that the pursuit of knowledge about the laws that govern the sounds of the piano is inimical to the art of tuning. After all, no tuner today can be considered qualified without knowing the aural tests for octaves, fifths, and so on, without understanding that intervals increase in speed as they ascend, without knowing that the major third F3-A3 beats at about 7 bps, yet the calculations that made this now common knowledge available were backbreakingly difficult and obscure at the time they were first made. My seven pages of tables, daunting though they may have seemed to Mr. Harmon, are simply part of an attempt on my part to abstract some of the laws governing temperament tuning in the hope of aiding us all to tune more accurately, efficiently, easily, and yes, artistically.

More on PACE Tuning #15, Step 7

[Regarding PACE Tuning lesson in November, 1994 PTJ, and Fred Yonley's question in February, 1995 *Journal*]

We've been using the terms "equally rising" and "place A-C# halfway between its neighbors" to express this concept:

7. Tune C#4 to obtain equally rising contiguous major thirds, F-A, A-C#, C#-F. In other words, the beat of the A-C# third should be halfway between its F-A and C#-F neighbors. This gives you the correct beat rate for A-C# whether or not your guess for F-A was correct. This is true in general; the central third of an equally rising triple of thirds in a correctly tuned octave is always the correct width for the piano. Now C#4 is in the right place.

Dr. Al Sanderson, RPT

The State of the Art

Ruth Brown, RPT
Southeastern Pennsylvania Chapter

[Editor's Note: Some readers may object to coverage of a subject including substantial information on a particular product. Some articles in this issue make detailed reference to Dampp-Chaser products. Since the Dampp-Chaser products are in such widespread use (and misuse) in our field, I feel that the product information included in this issue is important for our readers and is for the good of the order.]

This article was prompted by an Internet discussion last fall among several piano technicians. I do not know the names of the participants, but I've read some of the questions and answers. Some comments are at quite a sophisticated level, while others are not. There was enough confusion apparent in the discussion to make me aware that there is still a great deal of misinformation, or misperception, on the subject of relative humidity, especially as it relates to our particular reason for needing to understand it — the piano.

Relative Humidity

Let's begin with just a basic definition of relative humidity.

1. There is moisture present in the air, an actual, or absolute, amount.
2. Air is capable of holding varying amounts of water, depending on its temperature at the moment.
3. When air is heated, it expands. The enlarged molecules of the expanded air are then capable of holding more moisture.
4. Given the same absolute amount of moisture, the heated air now has a lower relative humidity, because the capacity of the air to hold moisture has increased, relative to the absolute amount of moisture present. As the relative humidity decreases, there will be a transfer of moisture from porous materials, such as our skin, and wood, into the air as they all equalize moisture levels.
5. Conversely, but once again given the same absolute humidity level, cooling the air will decrease its ability to hold moisture, so the relative humidity will increase. Now the porous materials, such as wood, and our skin, will take on moisture. If the moisture level exceeds that which the air can contain, condensation will occur in some form.

In the most basic terms, moisture is seeking an equal level with the surrounding area. PTG's Technical Bulletin on Humidity Control explains this phenomenon very well.

Seasonal Changes

In my area, southeastern Pennsylvania, this translates loosely into dry winters and wet summers. This is not because the moisture, or absolute humidity, changes. It is because we have cold winters, and heat our homes for our temperature comfort. This heated air, being capable of holding much more moisture than when it was cold, has a significantly lower relative humidity. Our summers are hot, with periods of extremely high humidity.

The reason I say "translates loosely" is that there are so many variables. For instance:

Temperatures vary from -10° to 50° F. through our winter months. This in turn affects use of heating systems.

Our spring and fall are of moderate temperature and frequent rain. This means that our personal comfort level is high, but the wood in our homes and pianos is at higher than normal moisture levels. Heating and/or air conditioning systems will be on sporadically.

Summers run from 60° to 100° F. Humidity can be anywhere from 30 percent to 100 percent outside. The inside levels vary drastically from home to home depending on home construction, preference for fresh air vs. air conditioning, etc. The city of Philadelphia is located between two large rivers, like Manhattan. There are scores of creeks, marshes, wooded lots, hills and valleys. We are very close to sea level.

It is not at all uncommon here to find pianos (with no humidity control) 30-40 cents sharp in the tenor during August, and the same note 30- to 40 cents flat in January.

Dampp-Chaser Products

Since many of the comments in the Internet discussion referred loosely to "Dampp-Chasers," allow me to define "Dampp-Chaser."

When Allen Foote first introduced "Dampp-Chaser" to the piano industry some three decades ago, it was with a dehumidifier rod, which had a 3-way switch on the cord. The three positions were for 8 watts, 15 watts, and 25 watts (low, medium and high). As important, there was also an "off" position. The switch was on the cord,

so it could be accessed without removing piano case parts. The Dampp-Chaser name still implies, in the minds of many, this original dehumidifier rod.

In its original form, the equipment was designed to be flexibly used by its owner. The capacity for change was built in. However, it often did not get used properly. People found it too difficult to know, or be bothered with, when the humidity situation called for which setting. More on this later.

Foote responded by adding the humidistat to the equation. This meant the dehumidifier would automatically turn on and off as needed. He also built a humidifier, plugging it into the same humidistat, which then automatically cycled the two sides back and forth as needed. The original dehumidifier was developed as several separate wattage and length rods to accommodate various needs.

Over the years, many changes came. The wicking material for the tanks was changed at least twice, for greater longevity. A smaller tank than the original 3-gallon one was made. A decorator top was designed to improve the appearance under a grand. In a large step towards making the equipment easier for the piano owner to use, the low-water warning light and watering tube were introduced. Another major improvement came with the introduction of the reservoir made for grands, which would not hang down so far below the beams.

Although these changes had already been with us for years, the majority of tuner/technicians were still installing only a single dehumidifier rod, a "Dampp-Chaser." Many of those would also use the humidistat with the rod. But very few had delved deeper into the humidifying side of the equation, let alone adding more dehumidifiers, experimenting with placement, and so forth.

In 1986, Bob Mair and Steve Smith bought the company. Bob, as an engineer, began testing the equipment. He liked what he saw. They both spoke with many of us who were installing lots of their materials to get ideas for improvement. The results of their efforts have been around for years now. Here is a current summary of components available from Dampp-Chaser:

- A whopping 21 dehumidifiers, everything from 8 watts and 12 inches, to 50 watts and 48 inches.
- Four different humidistats, including the basic model, one set at higher RH, a third set at lower RH, and one which accepts two low-water warning lights.
- Three different humidifiers, including the vertical, the grand, and the "short tank."
- Three different low-water warning lights, including one for each of the listed humidifiers, plus one of each with a beeper added, plus any of them set up with two lights/dual humidistat.

To summarize: "A Dampp-Chaser" is a misnomer. "Dampp-Chaser" is a company. It manufactures humidity control equipment. The control part is in the hands of the installer, who selects the proper components for the situation, and installs them in such a way as to control the relative humidity problem.

These components are available packaged in various systems, which can be very effective as they come, if installed properly. But it is up to the installer to judge the effect the system is having, and to know if more wattage is necessary, for example, or if the placement of the components in a different fashion will produce a better result. Perhaps more components are needed.

At every seminar, a class is held for the purpose of answering questions. In the last year, a new "field experts forum" has been initiated. Three to four installers each present a few things they feel are important, and a question-and-answer period follows. The company's 800 line is always available. One's supplier should be able to intelligently discuss any situation which arises, or questions you may have.

Even in the days of the single 3-way heat bar, the equipment was not faulty. Its use was. There has been an ongoing effort to respond to this by constantly producing items that make it possible for the piano owner to do nothing but write the initial check, and then water the thing when it tells them it's thirsty.

That's it.

Humidity Control in Actual Practice

I was fortunate to start my work with someone who already had decades of experience with woodworking on an industrial basis, and actively promoting humidity control to his piano customers: Webb Phillips, RPT. This came from seeing how crucial it was to the manufacturing process to control the environment. Control over the humidity meant make-or-break to the manufacturer. The RH had to be maintained in a very narrow range, or parts simply could not be assembled. Glue joints would fail. Finished items could split in transit as they passed through drier climes than that of the anticipated destination. (Manufacturers dry wood to an "EMC," equilibrium moisture content, based on the area where the product will most likely be used. To use an extreme example, think of the differences between Hawaii and New England.)

As I began tuning for Webb's clients, I quickly saw pianos which were controlled and those which were not. At that time we still often encountered single rods which may have even been factory- or dealer-installed as a sales promotion, so I saw the effects of them. (That varied tremendously according to the owner's understanding of how to use it.)

Many homes today are equipped with both humidifying and dehumidifying equipment. We need to discuss how these work in order to understand

their effects on relative humidity.

Humidifying:

- Furnace humidifiers add moisture through the vents of forced-air systems to help compensate for the drying effects that heat is causing. The relative humidity with this aid will be higher than without. However, it will not be stable unless the outside temperature and humidity, and the heating level, are static.
- Good room humidifiers are equipped with humidistats, which can be set to low, medium or high. They have fans or vaporizers to send out moist air. This air is cold.

The Society of Heating, Refrigeration and Air Conditioning Engineers has a chart with recommendations for indoor humidity levels at various outdoor temperatures. Please refer to Bob Mair's article and the Aprilaire reference for more on this. It's extremely important to understand the concepts they illustrate.

Dehumidifying:

- The only true dehumidifier for a home is one with a compressor. It takes actual moisture and condenses it into a container, which is then emptied down a drain.
- Air conditioning, designed primarily for temperature control, may also remove some moisture from the air.

Problems.

There are many. We'll start with air conditioning.

Most of us use air conditioning for our comfort. This means that when the temperature surpasses our comfort level, we want the air cooled. Remembering the discussion of relative humidity, we see that cooler air actually can hold less moisture, which means the relative humidity rises! Of course, air conditioners usually remove moisture through a condensation process, like a room dehumidifier. But the first problem is, what was the relative humidity before the AC was turned on? Perhaps low to begin with? Remember, this is not about the temperature, it's about the humidity and what is happening to the wood moisture content in our pianos. Perhaps it was excessively high. Then the AC will help somewhat. But the degree to which it will help will be affected by many things. One of these is super-efficiency, where the temperature is cooled more quickly than the moisture is able to be removed. A truly satisfactory environment, such as is needed for museums interested in preserving paintings, must take into account the humidity level for the items being preserved, *and* the creature comforts of the museum-goers.

This is a lot to ask of a homeowner. Even those who have air conditioning and the best humidifiers like to open their windows, after all. I find that extremely few homes use the available equipment to the maximum. People simply don't live that way.

Another problem is that, even with 24-hour-a-day air conditioning, such as where an asthma sufferer resides, the level of humidity is not brought as low as the high which can be achieved in the heating season with humidification.

A cold moisture has a major drawback: rapid condensation due to cold temperature. While this can be fine in a room, it's obviously unacceptable in pianos. I have seen many fine grand pianos fully coated with mildew and rust where they were subjected to room humidification only.

The most important realization must be that all of these things help, but none can produce a consistent result. The more the piano owner does will help. But it takes many factors working together to produce true success.

Humidity Control Systems in Operation.

Now for a look at how the Dampp-Chaser systems function. The single most important component is the humidistat (see Figure 1). This operates differently than any other such item, because the other components are all based on heat, and relative humidity, rather than actual humidity.

When the humidity level is too high, the air in the small area being controlled is heated just enough to allow it to expand; enough for it to be capable of holding the amount of moisture present. As the relative humidity decreases, the sensors in the humidistat respond by switching the power over to the humidifier side. The heat element in the humidifier is then powered. Moisture is now evaporated into the air. The relative humidity will increase. Long before this moisture

Figure 1

could ever reach a high enough relative humidity to condense, the dehumidifiers have gone back to work.

This cycling means that one side or the other is always working. This is similar to heating as well as cooling elements in refrigeration. The closer the tolerance for temperature of refrigeration required, the more closely set must be the components which control it. The same is true of the piano humidistat. Its design allows it, when used properly, to control the relative humidity to an extremely narrow range.

The element of heat also allows for much greater evaporation than a simple sitting pan of water.

The fact that heat rises is another plus. This means the air, whether dried or humidified, will get to a larger area than its immediate location.

The whole concept depends on even distribution of humidifying and dehumidifying the whole instrument. The components *must* be selected based on size of the instrument, its condition, and its location. One size does not fit all!

Feedback to the control is also imperative. For example, I checked an upright which was not holding a tuning, though tuned every 3-4 months. It had "a system." As it turned out, there were three good reasons for the lack of tuning stability. The wattage of dehumidifiers was insufficient, one of them was too close to the humidifier, and the control was badly placed. Once these problems were corrected, the piano stabilized completely and now can be tuned just twice yearly, and sounds better after six months than it used to after three.

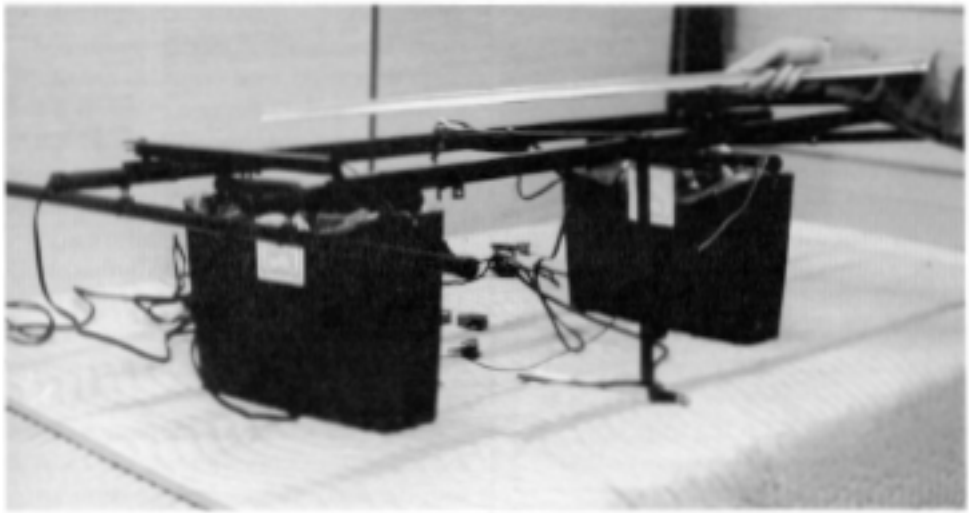
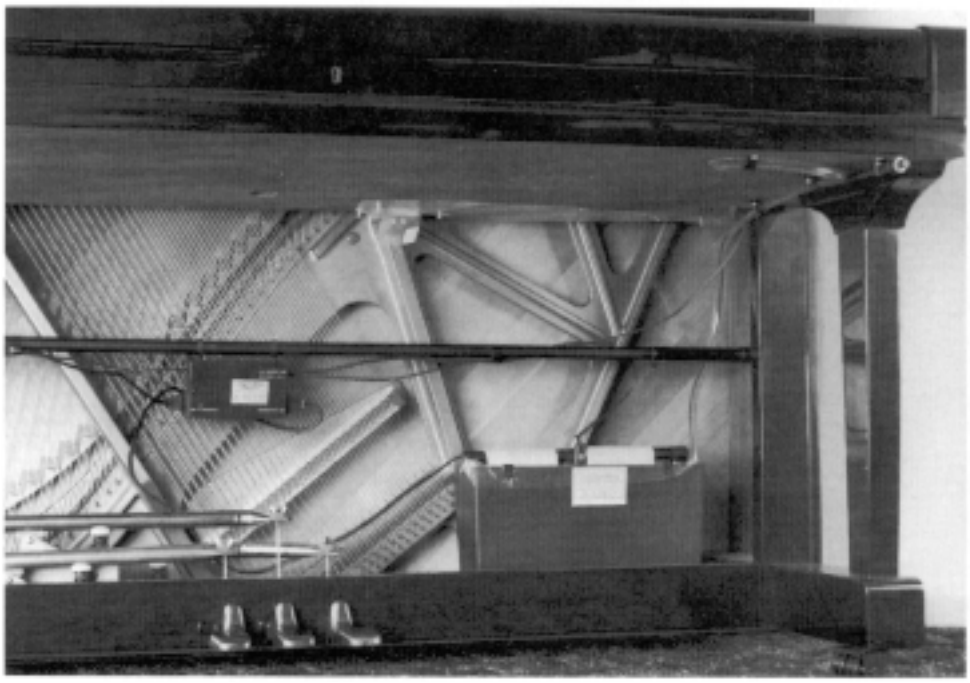


Figure 2

The surest test of the quality of your installation is pitch movement in the tenor. This can be reduced to such negligible amounts as one- to two *cents* from season to season. If the pitch is not that stable, more needs to be done.

It is not possible to see a piano in one season and know that the situation is stable. I have researched extensively in the field, checking instruments in different seasons. The pitch may seem very level in August, then take a dive in December. This simply means adjustments are required. Of course, you reach the point where you can "guesstimate" so well, you rarely make changes.

If the piano goes out of tune "all of a sudden," barring a change in the room conditions, almost invariably there is insufficient drying power or poor layout of components. Either will cause instability during a seasonal change. The level of dehumidification may be sufficient to stabilize pitch for dampness, but not at a low enough level to be consistent through dryness.



A typical vertical piano installation

Additional Concerns.

I have heard concerns regarding opening upright pianos with systems installed. Not using humidity control

for this reason may be compared to foregoing a single M&M after downing a Big Mac and super-size fries. In other words, the effect is so negligible it doesn't exist. (This assumes that the proper components for the environment are being used.)

Another inquiry involves moving of stage grands from protected stage boxes to open areas. Study the photo in Figure 2 and you will see a rack system we have used inside such boxes, which can be easily removed right at concert time. With the wide range of components available, many other options are now possible.

One of the forum questions was about grands with a dehumidifier in the action area, under the pinblock. My response:

We never, ever install a drying rod in a grand action without a separate humidistat. That goes next to the #1 bass string, with the sensors down (right-side up). It's only logical that this is a small cavity, and doesn't take much heat to dry. Only an 8-watt rod should be used, and even then, only with a control.

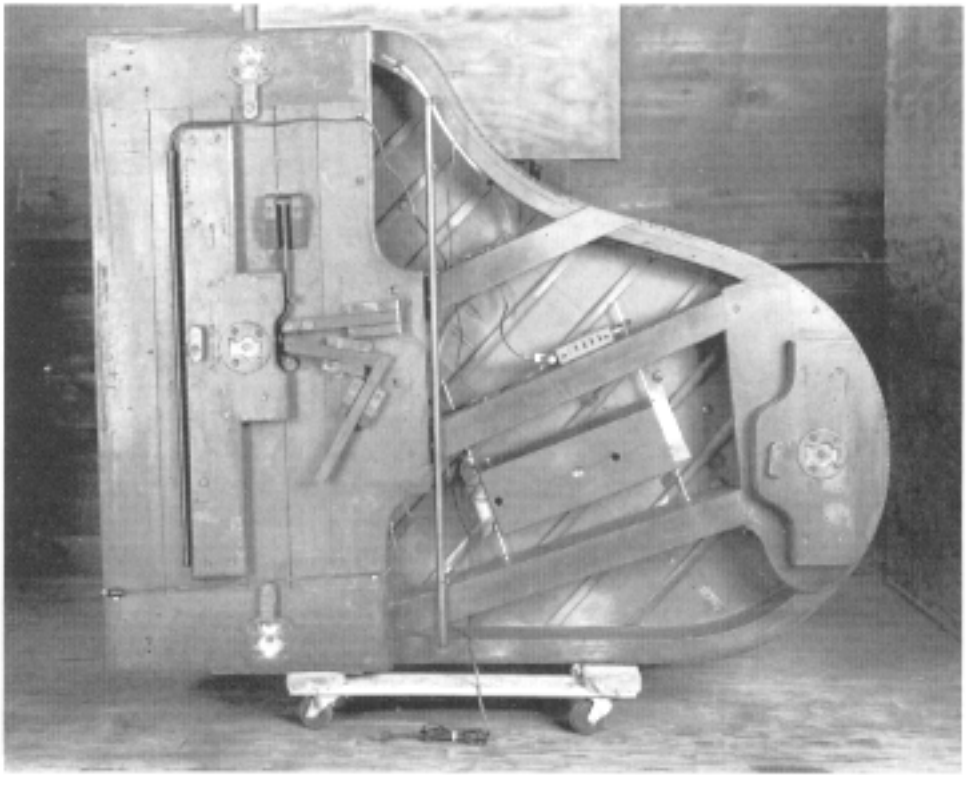
This said, a dehumidifier rod will still not ruin a pinblock which was not already bad. Dryness alone from this source will not cause glue failure and delamination. What will is dampness. This erodes the glue and damages the wood. Once the block has been so damaged, it will separate, with or without help.

Yes, I have seen grand pianos loaded with mildew on the soundboard, bridges, beams, rim and lyre, and one little dehumidifier rod in the action cavity. Every glue joint in the instruments fails. Not because of a rod. Because of moisture. Someone sees this rod, and the condition of the piano, and draws the conclusion that the equipment is faulty. The rod was misused, and the rest of the piano ignored. In other words, you can't argue that the dehumidifier was bad, only that the installer was extremely careless or unknowledgeable.

In my early days of installing these, I often met resistance. For one thing, tuner-technicians had no choice in days gone by but to cope with the ever-changing humidity situation. Pianos reacted, and technicians had to know how to deal with it. I can imagine I would be very proud of my abilities in this area were I working back then.

But humidity has always been acknowledged as a problem. The earliest piano warranty I have seen states that "this warranty does not cover ... unreasonable extremes of exposure. The presence of rust on metal parts of the instrument will be considered conclusive proof by that it has been affected by dampness."

I think of the change from repairing pianos to preventing problems as similar to what's happened in dentistry: tooth bonding and fluoride, instead of cavities and caps. After all, if we accept technology enough to use the Internet, we may as well go another step and try prevention as a way of servicing.



A typical grand piano installation

What Proper Humidity Control Can Do

- Keep wood and wool at a consistent moisture level, meaning:
  - Pitch stability, since the soundboard movement is kept to a bare minimum.
  - Action stability, since upright rails and grand keyframes don't fluctuate.
  - Wool preservation, since these porous fibers no longer take on and give off moisture, which hardens the fibers and ruins them.
  - Moisture is prevented from condensing on strings, springs, pins etc., so no rust.

What Humidity Control Cannot Do

- Correct friction problems where they have passed the point of just being swollen. Rough wool fibers in action centers and key mortises must be ironed, reamed, or replaced.

Corroded center pins must be replaced. Rail pins must be cleaned and polished, or replaced if plating is ruined. Easing of key bushings and balance holes must be done, but after the moisture has stabilized so you can discover what fitting is still necessary.

In the same vein, it won't regulate the action, though this example may give you an idea of how helpful it is: A 2-year old upright with its hammers 5.5 mm off the rail. One week following the installation of a humidity control system, they were down to 2 mm. Regulation was then a small matter. If I had regulated, and not installed a system, next winter would have found me with an irate customer and a lot of work to do.

It cannot repair a crack in a soundboard, though it may close one you find in winter.

It won't repair a delaminated pinblock, though borderline tuning pins may become tuneable. Even in grands, it will keep the soundboard from moving, so the pins don't have to be moved so far.

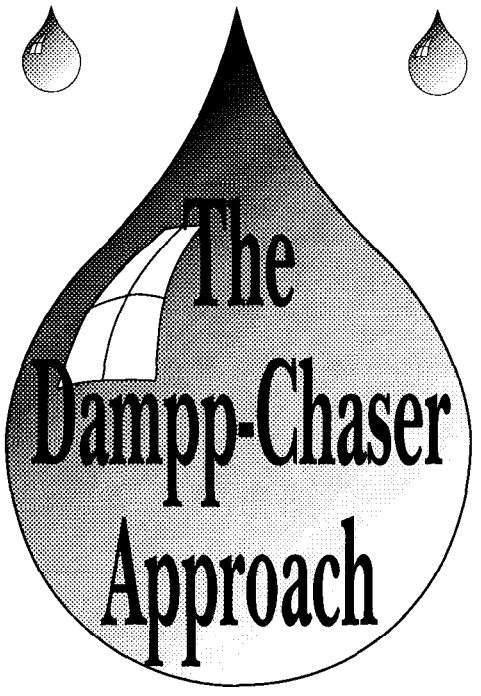
It won't put you out of work! Manufacturers recommend a *minimum* of two tunings annually, more when atmospheric changes call for it. That means that, without humidity control, four tunings per year is just about right, and more than that in concert and heavy-use situations. If you can get it down to two per year, and also preserve felts, soundboard, bridges, strings and regulation, this is progress.

Conclusion

One discussion participant stated that [humidity control] "doesn't keep pianos in tune — technicians do that." It's true that our tuning skills are needed, and the better our skills, the better the tuning.

But doctors surely appreciate patients who exercise and watch their diets. They are able to do more for them, and those healthy bodies are capable of greater endurance. Not to mention less stress on body parts, greater efficiency, a higher enjoyment of even routine tasks, and the power to pull off the demanding things without collapsing.

As our expertise in any service area increases, our expectations grow. Each plateau seems like the ultimate, until the next light bulb turns on. With continual narrowing of pitch changes, and increased action stability, we are free to concentrate on "fine-tuning." This is what makes our work so satisfying — always more to learn, always a better job to do.



To Humidity Control for Pianos

Robert W. Mair • Owner & President • Dampp-Chaser Electronics Corporation

Let's start with the general premise that when wood gets wet, it expands, and when it dries out, it shrinks. You've seen examples of this. In your home, doors and drawers stick in the summer. Molding joints, chair-glued joints and the like come apart in the winter.

More important to us, piano soundboards swell as the air becomes wetter and shrink as it becomes drier.

Relative humidity is defined as the amount of moisture in the air compared to the amount that the air can hold at that temperature. For example: 57 grains of water per pound of dry air at 70° F. will produce an RH of 50%. 67 grains of water per pound of dry air at 70° F. will produce an RH of 70%.

At 80° F., 57 grains of water produces an RH of 35%; at 90° F., 25%, and so on.

The numbers are not important. What is so very important is the concept that relative humidity is a function both of the amount of moisture in the air and the temperature of the air.

In the summer, 70% RH at 70° F. isn't terribly uncomfortable because the temperature is reasonable. There are 78 grains of water per pound of dry air. If the temperature goes up to 90° F. you would expect the comfort level to be poor, but the humidity level has dropped to 36%, so the comfort level is not too bad. One summer day in Denver, the RH was 90% at 4 a.m. with the temperature at 58° F., while during the previous afternoon, it had been 100°, and was reasonably comfortable because the humidity was 23%.

My feeling is, that these very significant RH swings are relatively commonplace in Denver.

Now out of this the things that are worth remembering are: as temperature goes up the RH% comes down. As the temperature comes down the RH% goes up. Of course if there is a weather front coming through or one turns on a piece of equipment that introduces moisture into the environment then the amount of moisture in the environment changes and the humidity will go up or down without a temperature change.

As the RH changes, so will the amount of moisture being held by the wood in the piano and the wood will change dimensions. This amount of moisture is called moisture content, and is generally expressed as a percentage of its weight compared to the weight of the wood. There is a direct relationship between relative humidity and moisture content. There are tables you can look at that tell what humidity levels will produce what moisture content.

At Dampp-Chaser, in our experimental work we measure moisture content and use this as the basis for judging whatever change we happen to be working on at the time. Going way back, shortly after we bought Dampp-Chaser, I set out to prove that the Dampp-Chaser system worked, or conversely, that it didn't work, and that we had bought a pig in a poke. Prior to that there was no scientific data existing to prove or disprove its value.

Chart 1 represents the results of that study. What it says is this: add heat, make the RH go down and the moisture content of the soundboard will go down. Do the opposite and the moisture content of the soundboard will go up. We have done this experiment a number of times, adding such measurements as the movement of the soundboard, how much various notes changed in pitch, and so forth.

One of the more recent experiments was done on the Disklavier MX100 that Yamaha let us use to develop the system for this piano. You will note two things from Chart 2. The moisture content of the soundboard without a humidity control system ranged from 10.5% RH to less than 5% RH as the humidity changed from 70% to 24%. This was a change of 5.5%.

With the humidity control system, moisture content varied from 8.7% RH to 6.7% RH, or a swing of just 2%.

More recent experimental data says that the humidity control system actually does somewhat better than this, so the system really provides greater benefits than this portrays.

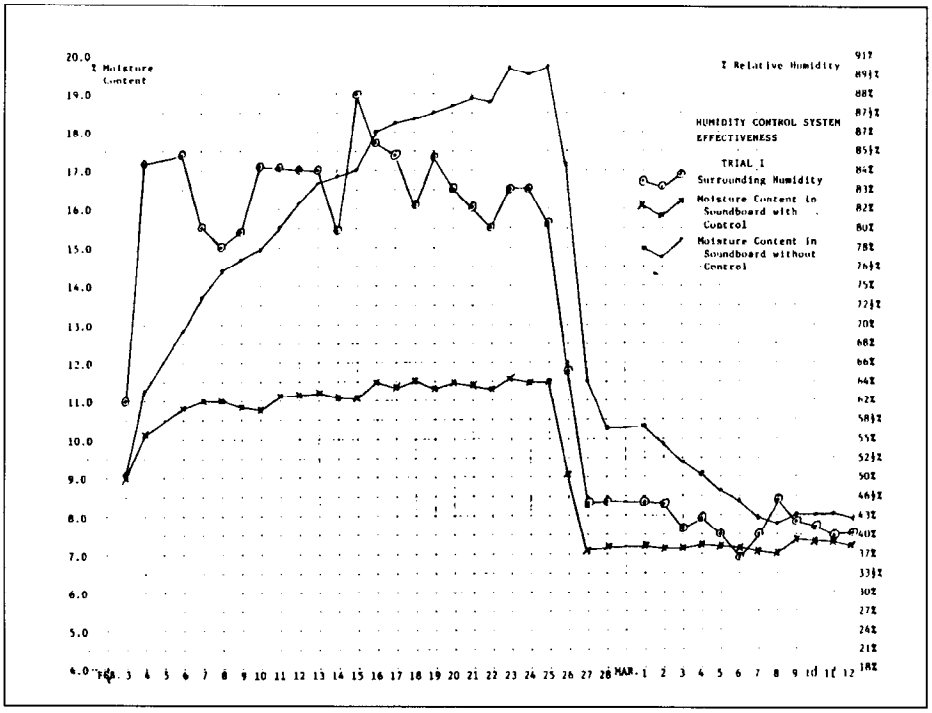


Chart 1

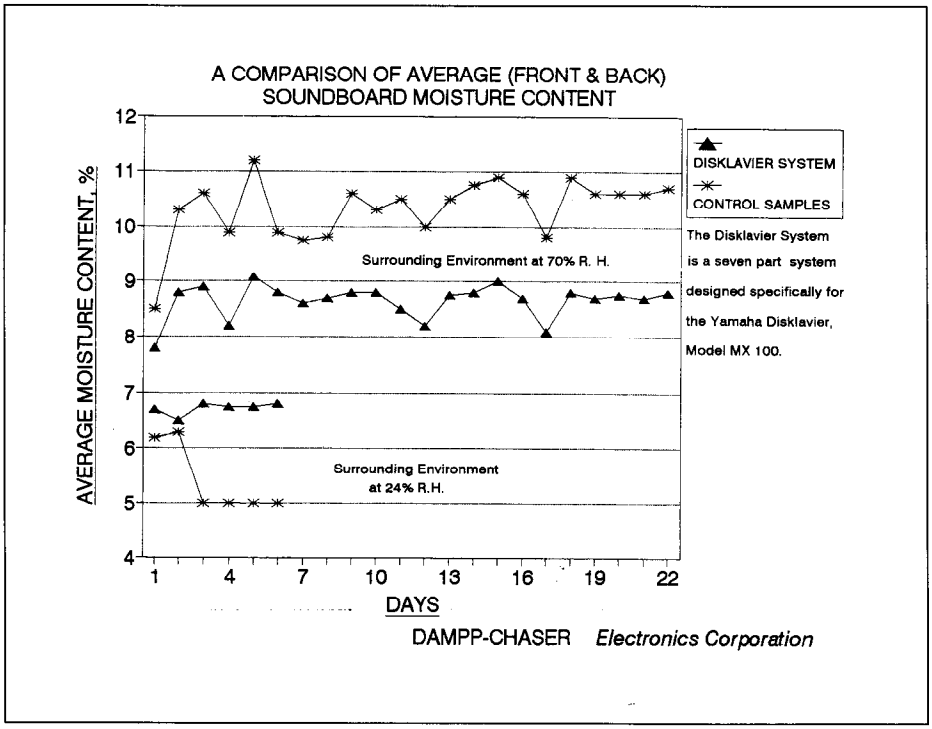


Chart 2

Perhaps I've put the cart ahead of the horse by providing the results before describing how the system works, so let's get into that for just a minute.

The key to the system is the humidistat. It turns the dehumidifier on at 50% RH and it stays on until the humidity gets down to 38% RH. At this point the dehumidifier goes off and the humidifier comes on. It stays on until the environment gets back to 50% RH, at which time the cycle is repeated. There is never a time when one or the other is not on. This is the most commonly misunderstood aspect of the system, and it's the one we need to do a better job educating people about.

The humidistat operates a dehumidifier or dehumidifiers. They simply increase the temperature, which in turn reduces the RH. This provides continuously reduced RH air playing on the soundboard. While the actual mechanics are somewhat more complex, this lower RH air gradually reduces the moisture content of the soundboard.

The opposite holds true of the humidification process. When the RH level gets below 38%, the humidistat turns the humidifier on. This produces high humidity air that plays on the soundboard, raising its moisture content. It's a simple cyclical process that goes on and on.

Now why not do as the motherhood and apple pie people say to do, and only provide humidity control to the room in which the piano is located? There are many reasons. One of the most important is: A reasonable humidity and temperature level in a home produce a vapor pressure that is significantly higher than that ouside when the outside temperature is less than 30 degrees F. The two pressures try to equalize, meaning the inside pressure tries to get ouside and thus has to move through the wall structures of the house. In doing so, the humidified air meets cold air within the wall, where it condenses, and then freezes. The parts of it that are between joints expand during freezing and expand the joint. The wall gradually deteriorates and eventually fails.

Companies that produce room or furnace humidifiers provide warning about how much to humidify the house for a given outside temperature. Aprilaire even makes an adjusting mechanism that does this automatically.

From personal experience, when I was living in Syracuse, NY, I didn't pay attention to what the warning said and put as much water into my house as I could get out of the furnace humidifier. The result was substantial icicle formation under and coming out from the shingle siding under several windows.

Aprilaire's table follows (as produced by the American Society of Heating, Refrigeration and Air Conditioning Engineers)

Now the point of all this is that you can humidify the *piano* to the 38- to 50 percent level during the winter months with a piano humidity control system, but trying to humidify the *room* in which the piano is located to these same levels during the winter can lead to damage of the home. The motherhood and apple pie people are just plain wrong.

Over the recent years there has been a great deal of research work done at Dampp-Chaser to provide greater understanding of what is taking place within pianos with and without humidity control, and what changes in the system provide the most beneficial changes in the piano. With each passing year there are better systems produced for a broader range of pianos, just as there is more understanding gained. On your way through western North Carolina, stop by, meet us, and see what we do.

Outside Temperatures	Maximum Safe Recommended Indoor Relative Humidity
-10°F	20%
0°F	25%
10°F	30%
20°F	35%
30°F	35%

INHARMONICITY & THE TEMPERAMENT

ARTICLE • 7
Tuning the Inharmonic Temperament

Daniel Levitan, RPT
Contributing Editor
New York City Chapter

"After 1917, tempering became a skilled science based on universally accepted mathematical principles, and professional tuners now temper with similar results. There is little individuality, and the temperament sections of pianos tuned by different tuners match note for note when compared. Prior to 1917, tempering was an art..."

—Owen Jorgenson, Tuning

The "universally accepted mathematical principles" to which Owen Jorgenson refers in the quote are the ones that make it possible to calculate theoretically exact beat rates for the intervals of equal temperament. These beat rates form an interlocking system which is the basis of the modern approach to equal temperament tuning. We tuners today approach equal temperament in a much different way than did our predecessors in previous centuries, armed as we are with a sophisticated knowledge of how fast certain intervals in equal temperament can be expected to beat, how rapidly those speeds should increase as the intervals ascend the temperament, and especially of how temperament intervals interrelate — how, for example, a major third and a minor third can be used exactly to measure the width of 6:4 fifth; or how flattening the upper note of a major third will affect the beat rates of not only that third but also of all the other intervals of which it forms a part. This knowledge enables us to be more precise and consistent in our tuning than we could possibly be otherwise. In theory at least, and particularly on larger pianos in which temperament inharmonicity is not much of factor, all competent tuners are indeed nowadays capable of producing equal temperaments which vary little from each other.

We should recognize that this strong dependence on beat rates is a relatively recent phenomenon in our craft. The best tuners of previous centuries, lacking the knowledge of beat rates that we have, not to mention having different goals in their temperament tuning, must have heard temperaments with different ears than ours. Even today, there are many members of our profession who have only a rudimentary grasp of the system of beat rates, or who consciously avoid making use of beat rates to an extensive degree. This is *not* to say that their hearing is not highly refined, or that their temperament tuning is as a result necessarily inferior. As a CTE, I have learned that it is quite possible for an examinee to produce an excellent tuning, scoring in all areas of the test at the CTE level, and still have a very limited grasp of the beat rate tests on which most of us rely so heavily. Still, a knowledge of beat rates has proved over the years to be one of the most powerful tools in the tuner's toolbox, and an awareness of beat rates has become so widespread that even the least sophisticated tuners among us, and in some cases even our clients, maintain vague notions of the rates at which the intervals of equal temperament should beat.

Limitations of Theoretical Beat Rates.

Those who live by the beat rate, however, die by the beat rate, and it can be murder to tune a temperament in a piano with high inharmonicity if one relies heavily on beat rates. In the previous six articles in this series, we have tried to address this problem, exploring at some length the nature of temperament inharmonicity and its effect on the beat rates of temperament intervals. We have distinguished between primary inharmonicity — the inharmonicity of a single string, present in all piano wire — and secondary inharmonicity — the inharmonicity of an interval, which may or may not be present in a given interval, and which may even occasionally be negative. We have seen how the beat rates of temperament intervals are narrowed by the positive secondary inharmonicity that is typical of smaller pianos, and how those beat rates are then widened as we expand the temperament octave to accommodate that inharmonicity. We have considered the effect on temperament beat rates of changing levels of secondary inharmonicity within a particular temperament octave. Now, in this final article, we'll turn at last to the subject of actual temperament tuning in smaller pianos. As we have done throughout the series, we will restrict our discussion to temperaments set

within the octave F3-F4.

Rules for Inharmonic Temperaments. Let's first review the rules of thumb for tuning inharmonic temperaments that we developed earlier, in articles two through four of this series. These rules apply to all temperament tuning, whether aural or electronic. If we tune aurally, often we begin to tune a temperament using as our guide the ideal beat rates of intervals in a temperament with no secondary inharmonicity. As we progress through the temperament, we inevitably find that we are forced to compromise these ideal beat rates, and our rules of thumb can help us decide which compromises are more likely to be appropriate, and which are probably going to be counterproductive. If we tune electronically, we may wish to improve upon what the machine has given us, and these rules can help us decide where to alter the temperament with the greatest chance of making improvements.

1. Increasing the secondary inharmonicity of an interval, assuming that the fundamental pitches of its component notes remains constant, will make the interval appear to be narrower. Its beat rate will slow if the interval is wide, and speed up if the interval is narrow.
2. Under conditions of positive secondary inharmonicity, a fifth beating at the same rate at the 3:2 level as a fourth at the 4:3 level will be much noisier than the fourth.
3. The wider the octave within which a temperament is set, the more quickly will beat the fourths, major thirds, and major sixths, and the more slowly will beat the fifths, minor thirds, and major seconds.
4. Changing the size of the temperament octave does not affect the ratio of the speeds of the intervals of a particular size relative to each other.
5. As the size of the temperament octave changes, the speeds of the 3:2 fifth, the fourth, and the major and minor thirds will change at about the same rate; the speeds of the major sixth and the 6:4 fifth will change at about twice that rate.
6. The greater the reverse curve of the bridge in the temperament area, the more rapid will be the progression of wide intervals, and the slower will be the progression of narrow intervals, as the intervals ascend and descend the temperament. The rates of progression of the major sixths and the 6:4 fifths will tend to be altered to a greater extent than those of the 3:2 fifths, fourths, and thirds.
7. Temperament intervals whose lower note is a wound string and upper note is a plain wire string have reduced levels of secondary inharmonicity relative to neighboring intervals composed of either two plain wire strings or two wound strings.

Keep in mind that these are only rules of thumb, general guidelines that apply to many, but not all, temperaments. For example, in some instances intervals moving onto wound strings exhibit little change in secondary inharmonicity, especially when the wound strings are mounted on a separate bridge.

Projecting Beat Rate Expectations

Two Factors to Consider. It's useful to try to project, before we begin tuning a temperament, what sorts of beat rates to expect from that temperament. That task is made easier once we realize that the temperament intervals of almost all smaller pianos tend to vary from the ideal in much the same ways, and that the amount that they vary depends on a combination of only two factors. *The first is the overall level of secondary inharmonicity within the temperament octave.* For any particular octave size that we have chosen for a temperament, this factor determines the ratios between the beat rates of the various sizes of intervals. *The second factor is the direction in which, and the degree to which, secondary inharmonicity changes within the temperament octave.* This factor determines the rate of progression for each size of temperament interval. As we have seen, these rates of progression are unaffected by the size of the temperament octave. Taken together, these two factors determine the specific beat rate of each interval.

Before we begin tuning, then, we may wish quickly to gauge the degree to which these two factors will influence our temperament beat rates. A couple of simple aural tests can give us this information. (This testing process becomes less and less necessary as one becomes familiar with the scaling patterns of various pianos and with the inharmonicity characteristics of certain makes and models.)

Secondary Inharmonicity of Octave. The overall level of secondary inharmonicity in the octave is most easily gauged by comparing the 4:2 and 6:3 octave tests. The greater the difference between the two octave tests, the greater the overall inharmonicity of the temperament octave. For all practical purposes, the secondary inharmonicity of the octave can be expected to vary from the ideal level of zero in only one direction, namely, towards greater positive secondary inharmonicity. The secondary inharmonicity of the octave may be zero or close to zero, as in a large grand—or, perhaps, in a smaller piano in which the lower note of the temperament octave is a wound string—but in most smaller pianos we can expect there to be some positive secondary inharmonicity in the temperament octave. The greater the overall inharmonicity in the octave, the greater the degree to which the

temperament interval beat rates will be affected by our choice of temperament octave size. In a piano with extreme secondary inharmonicity in the octave, choice of octave size will usually be the overwhelming factor in determining interval beat rates.

Rate of Change Within the Octave. The rate of change of secondary inharmonicity within the temperament octave can be gauged by comparing the secondary inharmonicity of the lowest fifth in the temperament, F3-C4, to that of the highest fifth, A#3-F4. The level of secondary inharmonicity in a fifth can be determined by first tuning the fifth pure at the 3:2 level, using the major tenth-major sixth test, and then checking the degree to which it is narrow at the 6:4 level, using the minor third-major third test. Comparing the secondary inharmonicity of the two fifths at either end of the temperament gives us a good idea of how secondary inharmonicity changes over the temperament as a whole. (A more complete description of this test is found in last month's article.) We will usually find that the secondary inharmonicity curve in the temperament area ranges from nearly level, in a piano whose bridge in that area is straight or curves away from the upper bridge, to increasingly inharmonic as the intervals descend, in a piano whose treble bridge curves back towards the upper bridge at its lower end.

For the sake of precision, we should note that, except in the case of a temperament in which the fifths have no inharmonicity, zero progression of secondary inharmonicity in the temperament octave actually results in a slight rate of progression for the 6:4 fifths in this test. If the secondary inharmonicity is constant, the upper 6:4 fifth will beat about half again as fast as the lower, reflecting the normal progression of fifths under conditions of zero inharmonicity. In a temperament octave whose fifths show such a rate of progression, once the temperament has been tuned, the 3:2 fifths should progress slightly as well. Zero progression of the 6:4 fifths in the test actually indicates a sight increase in secondary inharmonicity in the lower part of the temperament. As a practical matter, we can ignore this discrepancy, and simply keep in mind that the progression of fifths in our temperament should reflect that which we find inherent in the piano when we test the fifths.

Guidelines for Small Pianos

Let's now take a look at each of the temperament intervals and see how their sizes and rates of progression may tend to vary from the ideal in a small piano tuned to a true equal temperament.

- 3:2 Fifths
  - ◊ Size: 3:2 fifths will tend if anything to be wider than in theory, even sometimes going pure or wide of pure if the overall inharmonicity is high and the temperament octave is on the wide side. A 3:2 fifth that is narrower than theory calls for is probably a mistake.
  - ◊ Progression: These intervals tend to progress less than any other interval, usually being all about the same size in the temperament octave, or else perhaps progressing slowly in either direction. Adjacent 3:2 fifths of significantly differing speeds usually indicate a problem area.

- 6:4 Fifths
  - ◊ Size: 6:4 fifths are quite often narrower than in theory, particularly in the lower part of the temperament octave, and more so if the temperament octave is narrow.
  - ◊ Progression: These intervals not uncommonly progress in a reverse direction in the temperament, becoming narrower as they descend.

- Fourths:
  - ◊ Size: Fourths are likely to be wider than in theory, especially towards the top of the temperament. A narrow fourth is extremely unlikely and signals a significant problem in the temperament, except possibly in the low end of a very narrow temperament octave with very high overall secondary inharmonicity and greatly increasing secondary inharmonicity towards the lower end of the temperament.
  - ◊ Progression: Fourths progress if anything more rapidly than theory calls for. In a temperament octave with significantly greater secondary inharmonicity in the lower range, they often speed up rather briskly as they ascend the temperament.

- Major sixths:
  - ◊ Size: It is difficult to characterize the size of major sixths in an inharmonic temperament. Although their range of sizes is usually about that of theory, they often progress so rapidly that the lowest sixth seems too slow while the highest seems too fast.
  - ◊ Progression: These intervals often progress very quickly. It is sometimes hard to accept that they can progress so quickly and still be correct.

- Major thirds:
  - ◊ Size: Usually major thirds beat in the range of the theoretical rates, but they are often noticeably slow in the lower area of a narrow temperament octave.
  - ◊ Progression: It's not surprising to find major thirds progressing more rapidly than in theory. Contiguous major thirds, particularly in the lower part of the temperament, may

have beat rate ratios that sound more like 1:2 or 2:3 than 4:5. Contiguous thirds beating at ratios close to 1:1 are a real danger sign, except when the lower note of the bottom third is a wound string. In that case, the higher secondary inharmonicity of the upper third will slow it down noticeably, resulting in a ratio that sometimes sounds closer to 1:1.

- Minor thirds:
  - ◊ Size: These are more often than not beating more rapidly than in theory, particularly in narrow temperament octaves.
  - ◊ Progression: Minor thirds sometimes seem to progress quite slowly, though they often beat so quickly that it is difficult to assess their progression accurately. A slow minor third, or a rapid progression of minor thirds, is a sign of trouble.

A Typical Small Piano

Keeping these guidelines in mind, let's picture what the temperament of a fairly typical small piano, with a moderate overall level of secondary inharmonicity and a noticeable increase in secondary inharmonicity as intervals descend, might sound like when tuned as a true equal temperament. If we were to choose a wide temperament octave, say a pure 6:3, we would probably find the 3:2 fifths close to pure and progressing hardly at all, or perhaps decreasing slightly in speed as they ascended; the fourths and major thirds beating noticeably faster as they ascended; the contiguous thirds beating in a ratio lower than 4:5, perhaps around 2:3; the major sixths progressing extremely rapidly; and the minor thirds beating quickly in the lower end of the temperament but not progressing as quickly as we might expect as they ascend.

All the intervals, in other words, would progress smoothly, but their beat rates wouldn't really sound like the beat rates that we have come to associate with equal temperament. Is there any way to make our temperament sound more like the temperament section on a large piano?

As a matter of fact, there is. When secondary inharmonicity made our temperament octave appear too narrow, we tried to approximate a more desirable sound for the octave by slightly distorting the temperament by widening it. Similarly, we can compensate for the effects of progressively greater secondary inharmonicity toward the lower end of the temperament octave if we slightly distort the temperament by sharpening the notes in the middle of the temperament.

For example, we can begin by slightly altering the ratio among the three contiguous thirds that bridge the octave—F3-A3, A3-C#4, and C#4-F4. If we sharpen the A3 and C#4 by the same amount we can speed up the lower third, slow down the upper third, and leave the middle one intact. For argument's sake let's say that we have sharpened A3 and C#4 by two cents each, with the result that our chain of major thirds no longer beats in the ratio of 2:3 but rather in the ideal of ratio of 4:5.

To restore smoothness to the progression of the rest of the intervals in our temperament, let's say that we will gradually sharpen the notes between F3 and A3, raise all the notes between A3 and C#4 by the same 2 cents that we sharpened A3 and C#4, and gradually reduce the sharpness back to zero for the notes between C#4 and F4, as shown in the chart here.

This slight distortion slows down the progression of the temperament intervals, making most of them sound more like those of an ideal equal temperament. The fourths in the lower part of the temperament, for instance, are widened, while those in the upper part are slowed. The progression of the major sixths is slowed quite a bit. The minor thirds progress more rapidly, and they are slowed down to more usual rates in the lower part of the temperament. The 6:4 fifths are slowed and their progression becomes more like their theoretical progression as well.

The 3:2 fifths are something of an exception; their progression is made to normalize somewhat, as they become wider in the lower end of the temperament octave, but this also gives them a greater tendency to be wide of pure. However, wide 3:2 fifths are, from one standpoint at least, desirable in conditions of high inharmonicity, because the wider the fifth at the 3:2 level, the less noisy it will be at the levels of higher coincident partials, which will still almost certainly be narrow—the 6:4, 9:6, 12:8, and so on.

All of these changes seem to have improved our temperament; and in fact most experienced tuners tend instinctively to produce temperaments on smaller pianos with this kind of distortion of equal temperament, the inner notes being slightly sharpened to mimic the sound of equal temperament under conditions of low inharmonicity. In fact, such a distorted temperament is almost inevitable if the temperament is tuned by some of the more popular temperament sequences. Any temperament sequence which begins by dividing the temperament octave into a chain of major thirds in a 4:5 ratio will tend to distort the temperaments in this way. The Baldassin-Sanderson temperament is one example. Its two basic assumptions, that major thirds beat at a 4:5 ratio and that

Note	F3	F#3	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4
Cents Increase	0	+0.5	+1	+1.5	+2	+2	+2	+2	+2	+1.5	+1	+.5	0

all the fourths in the temperament beat at roughly the same speed, practically guarantee that the temperament will be distorted to just the right degree to mimic more closely the beat rates of theoretical equal temperament.

In a temperament whose lower notes are produced by wound strings, a true equal temperament often produces beat rates that slow down as intervals move upwards out of the wound strings. Here again, the jump in beat rates can be smoothed over, in this case by slightly flattening the lowest plain wire strings.

The Aesthetics of "Real-World" Equal Temperament

Is it preferable to tune a true equal temperament, whose notes accurately divide the octave, or a slightly distorted one that in some ways resembles more closely the theoretical ideal? This is an interesting aesthetic and philosophical question rather than a pressing practical one, as the amount of distortion involved is slight, but there are good arguments to be made on both sides of the question. Tuning equal temperament is, after all, one of the principal things we get paid to do, and it would therefore seem that should be our paramount concern. On the other hand, we have no qualms about distorting the size of octave by widening it by several cents, and the amount of distortion needed in a temperament to compensate for the progression of secondary inharmonicity is usually comparable to or less than that. The effect of this distortion on the tuning of the notes beyond the temperament octave is a real concern. Unfortunately, the subject of inharmonic octave tuning is outside the realm of our present discussion. Let's just note that there are a variety of issues to bear in mind when we opt for any style of temperament tuning, distorted or not. In the end, we must face the fact that we can't retain all the hallmarks of the ideal temperament in our inharmonic temperament. We can divide the octave truly, or we can replicate some of the beat rates and beat rate progressions that are characteristic of the ideal equal temperament. Each of us has to decide which aspect of the theoretically perfect equal temperament is more important.

> ***"In the end, we must face the fact that we can't retain all the hallmarks of the ideal temperament in our inharmonic temperament."***

Let's say we do wish to tune a *true* equal temperament by ear. It is possible, as we have seen, to tune a solid temperament in a small piano, all of whose intervals progress smoothly, and yet still not to have tuned a theoretically correct equal temperament. That being the case, how can we judge, using only our ears, whether any temperament that we have tuned aurally is truly equal or not? The best aural clue is the progression of 3:2 fifths. If the 3:2 fifths progress in a way that closely mirrors the way that secondary inharmonicity changes with the octave, especially if the fifths are narrower at the lower end of the temperament and the rest of the intervals are tolerable at all, then it is very likely that the temperament has been tuned quite close to equal. But even then we cannot be absolutely sure. Even if we could hear the beating between the fundamentals of the semitones of our temperament—as we can do in the octave just below the temperament octave by playing successive minor seconds—our ears would be still be unable to tell us if we were hearing the correct progression of minor second beats.

The only way that I am aware of to confirm that we have tuned a true equal temperament is to check it with a tuning device. Here's how to do it. Set your machine to read note F3 at pitch F3 — in other words, the note's fundamental. Now read note F4 at pitch F4 — its fundamental. This reading will probably be several cents higher than the reading for F3; the exact amount the readings differ will depend on the degree of secondary inharmonicity in the octave and the size of the temperament octave you have chosen. Note this difference in cents between the two readings. This is the width beyond theoretical purity of the temperament octave, and, if the temperament has been tuned as a true equal temperament, each semitone in the temperament should be sharper than the semitone below it by one-twelfth that amount.

To check your temperament, zero the machine on F3, reading pitch F3, and then scroll from F3 to F4 semitone by semitone, sharpening the machine for each successive semitone by one-twelfth of the overall cents difference between F3 and F4. This is an extremely instructive way to examine an aural temperament after it has been set, even partially; for example, it is revealing to see how an aurally tuned chain of contiguous major thirds compares with the theoretically correct one.

Can't we use this technique to tune a temperament from scratch? Unfortunately, no; attempting to tune a temperament in this way usually leads to unsatisfactory results, for several reasons. One is the difficulty of tuning a note exactly in this range of the piano using the fundamental as a guide—it is very hard to distinguish small differences in pitch at this level. Any errors of even a few tenths of a cent at the fundamental, which are difficult to avoid making in the temperament register, will be greatly

magnified at the level of the fourth, fifth, and sixth partials, where most of the coincident partials of the temperament intervals are found. This is why notes in the temperament area are much more easily and exactly tuned using higher partials. When we use the machine set in this range to check the fundamentals of notes that were tuned aurally, however, we are looking at differences nearly an order of magnitude larger, in the range of a cent or two, and in that range the machine is reasonably accurate.

Another reason that a temperament tuned by machine in this way is usually unsatisfactory, even when the tuning is done with extreme exactitude, is the unpredictable way in which the inharmonic partials of piano strings vary from their pitches as predicted by the inharmonicity formula. These unpredictable variations are quite interesting, but we will leave further discussion of them for another day, our immediate concern in this series of articles being not note-to-note variations of inharmonicity, but rather the general principles of temperament inharmonicity. Let's simply note that when we tune aurally we tend not only to distort the temperament octave by widening it, and to distort the temperament itself by sharpening its inner notes; we also tend to distort the temperament ever so slightly on a note-by-note basis to compensate for the minute variations in inharmonicity caused by changes in scale, soundboard resonances, and so forth. Using a tuning machine to generate a temperament by tuning notes at the fundamental does not take these slight variations into account, and therefore the results are usually not acceptable.

> ***Aural temperament tuning is, and must always be, educated guesswork. Fortunately for us, the greater our education, the less our guesswork.***

Piano Tuning: Art or Science?

Compromise of the temperament octave; compromise of the progression of beat rates in the temperament; compromise of the individual notes of the temperament; is it a surprise to anyone that tuning pianos is a business of compromise? Rarely is any well-tuned temperament truly equal. Instead, each temperament offers us a range of acceptability—and standards of acceptability themselves, vary, of course, from tuner to tuner, and from situation to situation. The smaller the piano, the wider the range of acceptability. With an infinite number of octave sizes to choose from that lie somewhere between pure 2:1 and pure 8:4; and with, for each of those octave sizes, an infinite number of temperaments that lie between the exactly equal and the fully distorted, it's clear that there is no one correct pitch for any note of the temperament, no one correct beat rate for any interval.

We sometimes hear about techniques for letting a particular piano tell us what beat rate is correct for a certain interval. It might be more useful to think in terms of a range of interval sizes which the piano will accept. The piano is more a mute child than a sentient adult; it does not know what beat rates it wants or needs. Rather, it is our responsibility as technicians to decide what range of beat rates is acceptable for that piano, and then to decide on a temperament that is practical and that suits our style of tuning and the particular occasion.

There is, in other words, no golden road to aural temperament tuning, no foolproof way to arrive by inevitable steps at the ideal temperament for any particular piano, especially a piano with high levels of inharmonicity. Aural temperament tuning is, and must always be, educated guesswork. Fortunately for us, the greater our education, the less our guesswork.

Perhaps the most positive approach we can take to temperament tuning in small pianos is to accept that we have a range of options to choose from in terms of octave size and temperament distortion, and to take advantage as much as we can of those options. To be able to do so we first must gain through knowledge and experience the control that will enable us to tune well at a variety of octave sizes and levels of distortion. Then we will be able to more precisely tailor our work to the conditions at hand. Our reasons for tuning a temperament a particular way will reflect not only our personal tastes, but also the tastes and needs of our clients. With that in mind, let's close out this series by amending the quote from Owen Jorgenson that began this article. I think we can now safely say that, especially in the smaller instruments that make up the majority of pianos, the tuning of equal temperament remains an art.

TECHNO*stuff*

Richard Anderson, RPT • Chicago Chapter

This month I'll give one last illustration of tuning by remote control, and then I'll give the steps for developing hand-to-ear coordination, and Richard's Rules for Hammer Technique.

Tuning a piano is somewhat like driving a train. Train cars are joined together with couplers that have several inches of slack that allow the engine to start and stop the cars individually. If the cars were joined tightly, the engine would have to start or stop the entire mass of the train at once. Loose coupling allows the engine to start the first car by itself, and then the combined mass of the engine and first car starts the second car, and so on down the line.

Imagine you're in an engine coupled to two cars sitting on a siding waiting to unload some pianos. You need to move the second car ahead a few inches to line up with the dock.

- Start by moving the engine ahead to take up the slack between the engine and first car.
- Then move the engine and first car ahead to take up the slack between the first and second cars.
- Now move the engine and cars ahead a few inches and stop.
- But wait! The cars will continue to move ahead until the slack is put back in the coupling between the engine and the first car, and then between the first and second cars.
- Oops, too far. Back up and try again. It's like driving a slinky toy.

And so it is with tuning. Train engineers learn to feel the slack coming out of the couplers and judge how far to move the engine so that the last car ends up where it needs to be. We need hand-to-ear coordination to accomplish the same thing when we're tuning.

Hand-to-ear coordination is simply matching what you feel to what you hear as you move the hammer. Develop hand-to-ear coordination by these steps:

- Assess the condition of the piano and strings before tuning to predict how the wire will behave (range curve shapes).
- Listen to the strings that you're tuning before you move the hammer to find out how much the frequency has to change.
- Listen to what happens to the speaking length as you begin moving the hammer, and connect that with what you feel happening to the pin through the hammer. Lots of frequency change before the pin moves in the block means little friction and a narrow range. No change in frequency even after the pin has moved means lots of friction and a wide but unstable range.
- Move the pin in the block, let it relax, and listen. If the frequency needs to move further in the same direction, move the pin again. If the frequency has moved a bit past, adjust the tension in the front waste end and duplex. Play with that tension differential in both directions to judge the width of the range for that pin position and where the range is relative to the frequency. Remember that the more tension differential you put in, the less stable the wire will be. Keep moving the pin and adjusting the tension until the range is centered over the desired frequency.

Richard's Rules for Hammer Technique

1. *The tuning pin must move* in the block if the range isn't centered over the desired frequency. The most common mistake beginning tuners make is relying too much on tension differential, and not moving the pin enough. One rule of thumb for the center of the scale is if the frequency needs to change more than one beat, the pin must move in the block.
2. *The pin must move only as far as necessary* to move the range, which may or may not change the frequency of the speaking length immediately. On pianos with little friction, the frequency will change a great deal relative to the change in pin position. Make sure the pin moves on these pianos no matter how much the frequency changes initially. On pianos with lots of friction, the frequency may not change until the pin has moved well past the position necessary to center the range over the desired frequency. For these pianos move the pin only as far as you judge necessary and then rearrange the tension by pressing on the front waste end with your finger to increase the frequency of the speaking length, or pressing on the speaking length to reduce its tension and frequency.

Another method to deal with excess friction is to move the pin far enough to obtain the desired frequency in the speaking length, and then moving the pin back to where you estimate the range will be centered. Neither technique is fun, but is better than leaving the pin a quarter turn past where it needs to be.

THE TUNER

THE UNISON

Paul Monroe, RPT

Diverting from my usual format of articles directed toward the beginning tuner, I would like to continue the discussion of that interesting subject, the unison.

During my experience of teaching a piano tuning appreciation course in an adult education class, I discovered that no two people hear alike. Out of the three hundred-plus who took my course (six went on to become tuners), no two of them could hear the same.

The most unusual student out of the group could not hear any beats in the temperament octave, F3-F4. He could hear them in the fourth octave above. He could vaguely hear an octave in the wound strings but yet he could hear an octave very clear in the seventh octave. Some could not hear beats, others could hear them clearly. Some could not hear the difference between a unison out of tune by half a beat and one that was pure.

Spending a great deal of time analyzing and checking each student, including a discussion of their musical past, pointed out one very important fact to me. They really did not know how a tuned piano was supposed to sound. Almost all of them had their pianos tuned every five to 10 years because they thought they should, not because they thought they were out of tune.

This points up the fact that listening to an untuned piano trained their ears to accept what they heard with no thought as to whether it was right or wrong.

I believe this is related directly to the various discussions and articles on the subject of unison tuning. The writers of some articles say a pure unison is soft and dead. Others say a unison out of tune is objectionable and that a pure unison is beautiful. My feeling is that a pure unison sings out with beauty. The strident tones or even the slow beat of an impure unison are very distracting to me.

We go to great lengths and put a great deal of effort to establish the proper beat rates. We strive to have the clear beat rates increase evenly in speed as we progress up the keyboard, and the opposite when progressing down the keyboard. This great effort can be affected (destroyed) by unisons that are not pure.

Try the following experiment. With your muting strip in place in the temperament octave, tune F3-A3 to seven bps. Remove the muting strip from string #3 of note A3. Tune it so the unison is as pure as you can make it. Compare the beat rate of the interval, first with #3 string of A3 muted and then with the mute removed from string #3. The beat rates should be the same.

Next, retune string #3 of A3 so that there is one beat per second in the unison. Compare the beat rates again as you did before. You will notice a change in the beat rates of F3-A3 caused by the out-of-tune unison.

We should remember that the beat rate of the F3-A3 major third is created by the difference in frequencies of their coincidental partials. For F3 it is the 5th partial, 873Hz and for A3 it is the 4th partial, 880Hz (read William Braid White's book on partials). A unison that is not in tune causes all kind of conflict in the partial structures, creating a condition known sometimes as strident tones. Strident means harsh, shrill, rough, "martellato."

To further explain, when tuning the wound strings you can build in color by tuning with the use of coincidental partials, for example: In some piano scalings pure 12:6 coincidental partials will give you octaves that roll about one-quarter to one-half beat per second. To tune the bichords other than pure will destroy the color you worked so hard to attain when you were tuning the octaves.

In conclusion, I think we all must admit it is extremely difficult to tune unisons perfectly. In most pianos we tune, except maybe on the concert stage where the pianos are tuned very often and on a regular basis, to tune all the unisons perfectly is impossible. Therefore, I feel we don't need to try to distune unisons. Our human errancy will contribute enough.

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LESSON PLAN

Technical Lesson #19

Vertical Troubleshooting — Repairing the Sticking Key

by Bill Spurlock, RPT
Sacramento Valley Chapter

This monthly lesson plan is designed to provide step-by-step instruction in essential skills. Chapters are encouraged to use this material as the basis for special Associate meetings, or for their regular meeting program, preferably in a hands-on format. This method allows the written information to be transformed into an actual skill for each member participating

In brief:

This lesson concludes the vertical regulation portion of this series with a look at perhaps the most common of action problems, the sticking or sluggish key. Participants will learn a logical sequence of steps that allows quick and accurate diagnosis. Methods of correcting sluggishness, such as pinning procedures, centerpin lubricants, etc., are beyond the scope of this article. Teachers may want to expand this lesson to include repair procedures as time allows.

Getting started:

In order to pursue any serious study of piano technology, one must obtain basic resources. Catalogs from several piano supply houses, both large and small, are essential. Besides offering the necessary supplies, their pictures and item descriptions are valuable sources of information. Piano manufacturers' service manuals are also essential sources of valuable information. Most are available at no cost. Most important to participating in this Lesson Plan series are the PTG Exam Source Books, both the tuning and technical versions. Articles in these books will serve as reference material for the lessons.

Hands-on session setup:

To teach this lesson in a hands-on format, you will need one or more direct-blow vertical pianos. It does not matter whether these pianos have any sluggish action parts; participants can go through the step-by-step diagnosis procedure anyway, learning the test sequence and getting a feel for how each part should behave. Even on pianos having no apparent problems, some marginally sluggish action points may be found. If one or more of the pianos do have sticking keys, so much the better.

Depending upon time and pianos available, this lesson may consist of participants working individually on separate pianos, or taking turns observing and adjusting on a single instrument.

Estimated lesson time:

1 1/2 hours

Tools & materials participants must bring:

For this lesson, participants should bring a selection of regulating tools and repair supplies.

Assigned prior reading for participants:

PTG Technical Exam Source Book (PTG Home Office, 816-753-7747), pages III.15–III.18

General Instructions

The term "sticking key" is used to describe a variety of symptoms, from a note that will not sound at all when its key is depressed, to a note that plays once but will not always sound on the second blow, to a note that sounds every time but very weakly. Often the symptom will only occur on a soft blow, or after a very slow release of the key.

There are many points in the action that can cause these symptoms, so in diagnosing this problem we first need to have a solid understanding of how the action works and of proper regulation. Then, we must follow a logical, step-by-step sequence to test each possible problem spot. Without a logical test sequence it is easy to jump to a conclusion and treat the symptom rather than the actual cause of the problem. A step-by-step approach virtually guarantees you will quickly and correctly locate the actual problem.

Exercises

Participants should follow the test sequence below, performing each inspection or test on at least an octave of keys. If a problem part is found, it should be pointed out to others in the group so they can test it and experience the problem.

Diagnosing the "sticking key"

For the purposes of this lesson we will assume that our goal is to test each note on the piano to discover if there are any sticking keys and if so what is causing them. If instead we were addressing a customer's complaint about a sticking key, we would first need to question them carefully to make sure we understood exactly what symptom they were experiencing and under what conditions it occurred, then go on with our diagnosis.

Often the cause of a sticking or sluggish key will be immediately apparent, such as a hammer rubbing its neighbor or a key front binding against the key slip. In this case there would be no need to follow the diagnosis sequence below, at least not until the obvious problem was corrected. However in general, this sequence is effective for evaluating the common

problem areas. The order of steps is not important. The particular symptom you experience may lead you to follow a different order; however it is usually wise to do all the tests to make sure that all possible problems are discovered.

1. Quick visual check for rubbing parts or mechanical interference

- Play chromatically up or down while watching for rubbing hammers.
- Play chromatically up or down while watching for rubbing wippens, bridle wires, or keys (usually at the back ends of keys).
- Look for hammer butt springs out of place.
- Look for white keys binding on the key slip.
- Look for two keys that seem to be connected, usually caused by debris stuck between adjacent keys.

2. Check hammer return

A sluggish hammer will return slowly or only partially back to the rail. The usual symptom is a weak, loose-feeling key blow caused by the shortened hammer blow and excessive lost motion.

- For a fast wholesale test, depress and release the left (hammer rail) pedal quickly, watching to see if the hammers follow the rail back to rest without hesitation. Any sluggish hammers will lag behind the others. **Photo 1** shows several sluggish hammers left slowly moving back to the rail after this test.
- To test individual hammers, raise each half way toward the strings and release as shown in **Photo 2**. (Note: raise each hammer only half way or until its bridle strap becomes tight. Raising it farther lifts the wippen, adding the wippen's weight to the returning hammer and masking slight sluggishness.) A properly free hammer should fall quickly back to the rail and bounce slightly. As you go along, compare each hammer's bounce to the average. Slightly sluggish hammers may appear to return freely but will not bounce off the rail.

If sluggish hammers are found:

- Inspect for rubbing hammers.
- Check for weak, broken, or dislodged butt springs. Dislodge a suspect butt spring and let it swing up beside the hammer butt. Compare its "loose" position with that of neighbors as a measure of its tension. *Do not* add tension to the spring unless it is clearly weaker than others in the action.
- If there is no rubbing and the spring is good, the hammer butt pinning must be too tight. This can be confirmed by removing the hammer butt assembly and testing flange friction by swinging or with a gram gauge. Often a centerpin cleaner/lubricant can be applied to the part in place, and the part retested immediately. However, before using such treatments indiscriminately, one should have enough experience to judge the particular type of centerpin problem and what treatment is right for a given situation.

Photo 1: Press and release soft pedal quickly as a quick check for sluggish hammer return

Photo 2: Lift individual hammers halfway to strings and release, watching for fast return and a slight bounce off rail

The remaining checks are used to diagnose the problem of the jack not returning under the hammer butt when the key is released. This problem usually occurs after a slow key release. Its symptom is a note that will not sound or sounds very weak on successive blows, due to the jack skipping out early.

3. Test for jack return under the hammer butt

With the sustain pedal depressed, play each key and release very slowly, watching to see whether the jack returns fully under the butt. Non-returning jacks can be caused by lack of lost motion, tight wippen centers, tight jack centers, weak/broken jack springs, tight key bushings or key balance holes, and rubbing parts. Other, special causes of this problem are mentioned at the end of this lesson.

Photo 3: Pull back on hammer rail for a quick check of lost motion—the two hammers marked X stand off the rail, showing no lost motion

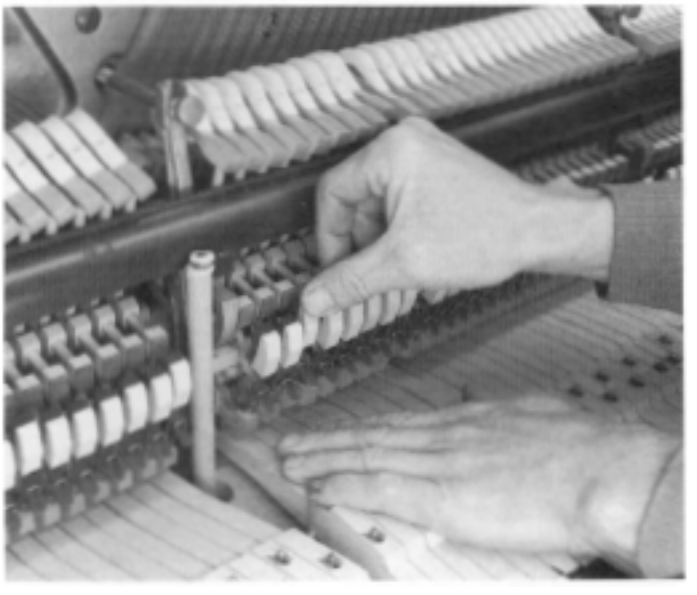

Photo 4: Check wippen flanges by depressing soft and sustain pedals, holding back ends of keys down, lifting wippens part way and dropping back onto capstans

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LESSON PLAN

4. Test for correct lost motion

- For a quick check, pull back on the hammer rest rail as shown in **Photo 3**; all hammers should follow the rail back slightly, indicating some lost motion. The two hammers marked with an "X" in photo 3 did not follow the rail back. Try lowering the capstan slightly on a note with a jack that does not reset, to see if more lost motion is needed. If the jack still fails to return under the hammer butt, proceed with the tests below. If most notes lack lost motion, it is usually most practical to add some by propping up the hammer rail rather than lowering all the capstans.

5. Test wippen centers

- Depress the soft pedal to raise the butts away from the jacks, and the sustain pedal to lift the damper levers from the spoons. This will allow you to isolate and check the wippen center. (Note: on tall uprights with stickers, the wippen center and the sticker flange centers are diagnosed together.) Holding each key down at the rear, lift each wippen just until its jack touches the hammer butt; then trip your thumb off the top of the backcheck to drop it, watching it fall back to the capstan as shown in **Photo 4**. Look for free movement and a uniform bumping sound from note to note. Sluggishness here indicates a tight wippen center (and/or sticker centers if so equipped.)

6. Test jacks

- Depress the soft pedal to lift the hammer butts off the jacks, then use a finger or small screwdriver to trip each jack as shown in **Figure 1**. Look for a snappy return and a uniform "thumping" sound. If any are sluggish, inspect their springs and pinning.

7. Test keys for free movement

- For a quick check, hold groups of wippens off their capstans and tap on the backs of the keys with the other hand, as shown in **Photo 5**. Keys should rock freely.
- For the most accurate test, check key bushings and balance pin holes individually. These points must be completely free for all parts to return reliably to rest so the jack can reset.
  - Test balance rail bushings by placing a finger atop each key button and pushing side to side, watching and feeling for the necessary slight play between pin and bushing.
  - Test front rail bushings by grasping each key at its front end, depressing it, and feeling for side play. *Note: hold the key button to one side with your free hand while testing the front bushing. This eliminates play at the balance rail that may falsely be felt as play at the front pin.*
  - Test the balance hole by lifting the front of the key approximately 3/4" and releasing. The

key should slide down the pin by itself or with the slightest touch.

8. Check with sustain pedal "off"

- Sluggishness due to tight key bushings or wippen centers is usually worse when the sustain pedal is depressed, since the damper springs are not helping wippen and key return. However sluggishness that is worse when the sustain pedal is *not* depressed indicates friction between the damper spoon and the underlever felt. Check for a rusty or roughened spoon, or a spoon digging into the underlever felt.

Additional problems unique to certain action designs

9. Spinet drop wire binding

On spinets with drop lifter wires, binding can often occur if the wires exert a side or twisting force on the key and wippen. See **Figure 2.** The wire may appear to be leaning to one side, or it may be vertical and the metal fork or holder in the end of the key may be twisted. In either case this misalignment twists the key to one side, binding the balance rail pin and putting a side force on the elbow and wippen flange pinning. The symptoms are identical to those of a tight wippen flange or key bushing: poor jack return after a slow key release.

To diagnose, push lightly side to side on the key button and look closely to see if the key appears to lean to one side. Also disconnect the drop wire from the key to see if the wippen pinning seems free. To correct this problem, bend the drop

Photo 5: Check key bushings by holding wippens off the keys, then tapping keys quickly

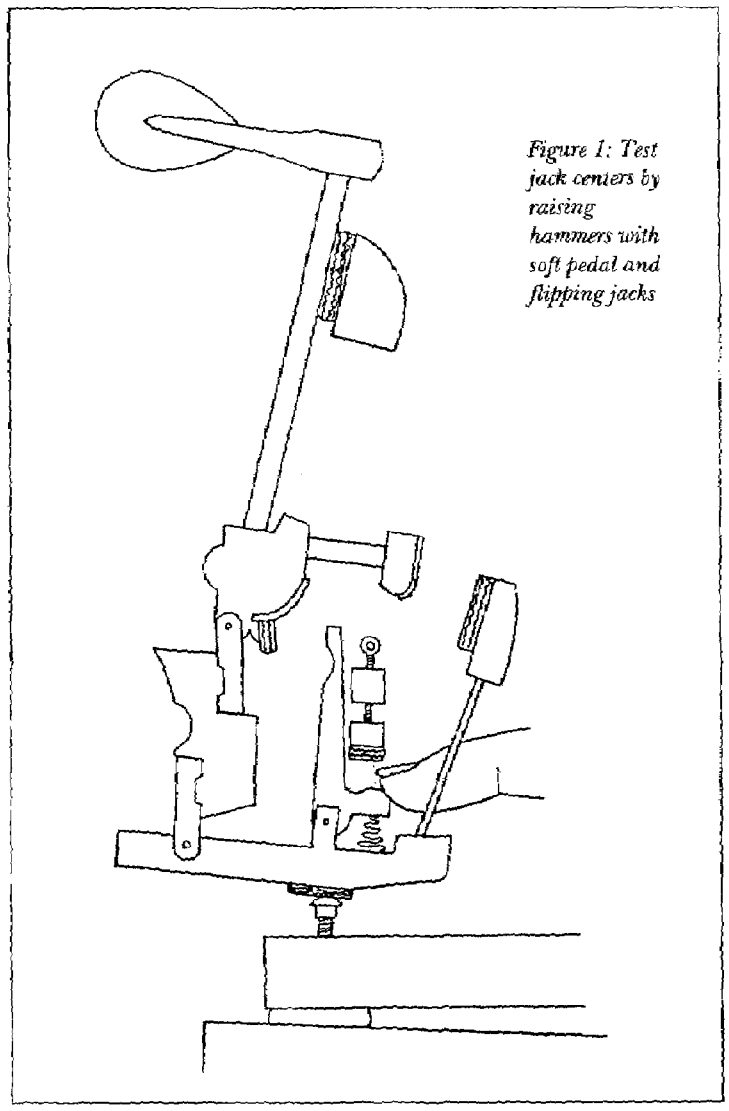
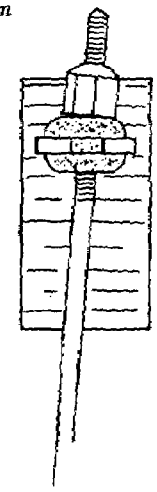


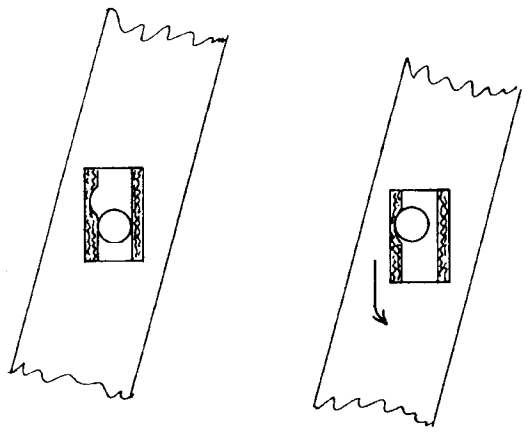
Figure 1: Test jack centers by raising hammers with soft pedal and flipping jacks

Figure 2: Misaligned spinet drop wires cause sluggish key return



A misaligned drop wire or bent key fork twists the key to one side, binding the balance rail bushing, elbow and wippen flange pinning.

Figure 3: Worn balance rail bushings on angled keys can cause sticking



A notch develops in one side of the bushing; when the key is depressed it leans over, trapping the keypin in the notch.

wire slightly to the left or right below the key (trial and error method) to relieve the side force. Also lubricate key pins with a dry Teflon spray.

10. Very worn balance rail key bushings on angled keys

Sharply angled keys can develop a notch in one side of the balance rail bushings due to their tendency to lean to one side when depressed. See **Figure 3**. The balance pin "falls into" this notch when the key is played. Often jack return is marginal on these pianos anyway due to lack of key leading and rough jack tops and butt coverings. If so, the worn key bushing can be just enough to prevent full key return. Replace the worn key bushings to correct. Also lubricate key pins with a dry Teflon spray.

11. Inadequate key leading

Some vertical pianos have leads in the rear of their keys and some do not. Leads are not necessary for all designs. However some pianos that really need key leads to allow reliable jack return have been manufactured without them. If all previous tests prove no friction problems exist, yet jacks still fail to return after a slow key release, the action might benefit from installing a lead in the back of each key. Use caution here and make sure you are not overlooking a friction problem.

12. If the hammer and wippen hang up together:

Occasionally, after a hard blow, a hammer butt and wippen will hang up together in the checking position. Pushing the back of the key down still leaves the other parts seeming to hang in midair, as shown in **Figure 4**. This problem is caused by the jack binding against the jack stop rail (either a separate rail or just a felt-lined regulating rail). The wippen cannot return because the top of the jack is being pushed against the rail by the hammer butt, while the jack centerpin is also forced toward the rail due to the arc of travel of the jack center. The remedy is simply to reposition the jack stop rail or regulating rail slightly farther from the action rail.

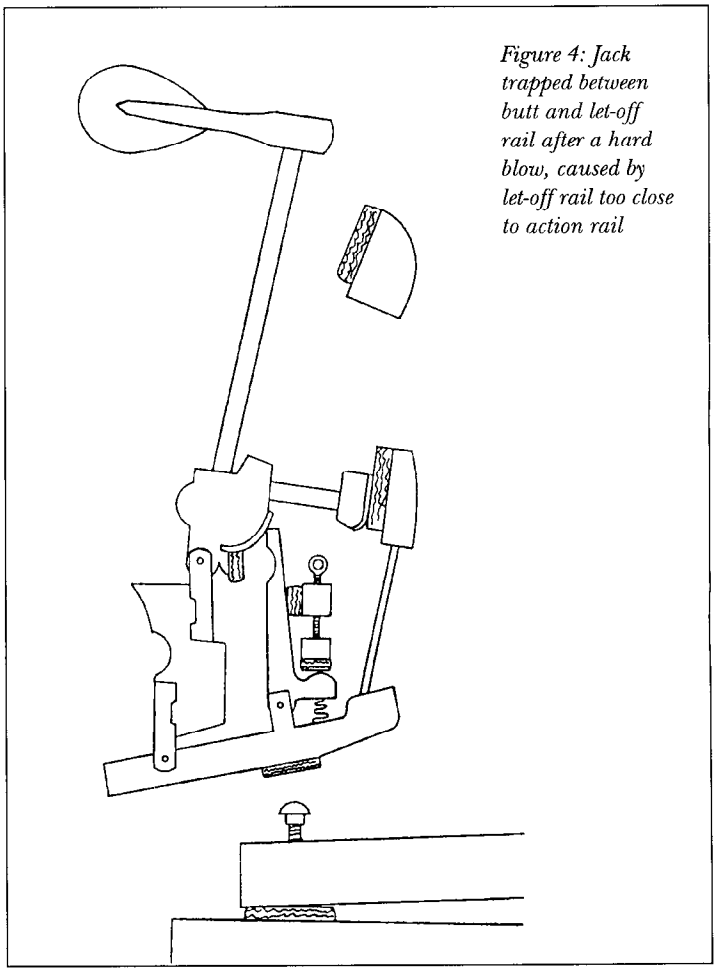


Figure 4: Jack trapped between butt and let-off rail after a hard blow, caused by let-off rail too close to action rail

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LESSON PLAN

Tuning Lesson #19
Tuning 8:4 and 10:5 Octaves in the Low Bass

by Michael Travis, RPT

Washington DC Chapter

This monthly lesson plan is designed to provide supervised practice of tuning skills as a supplement to independent study and practice. Chapters are encouraged to use this material as the basis for special Associate meetings, or for their regular meetings, or for their regular meeting program. Each lesson is designed to take about one hour, with about four participants. Participants are assumed to have essential reference materials and tuning tools (see PACE checklist) and access to a well-scaled large upright or grand piano for independent practice.

In brief

This lesson consists of practice in tuning low bass octaves. Participants will learn how to use one test each for tuning 8:4 and 10:5 octaves, and then will practice using these tests in tuning several notes in the range of A0-C2 from those an octave higher.

Background

For most bass tuning, we can rely on 6:3 octaves, as given by the equal-beating m3-M6 test (PACE Tuning Lesson #9, *Journal*, 5/94). In the low bass, a wider 6:3 octave (m3 < M3) often sounds better. On many pianos, and especially in the low bass area of larger grands, the octave tuning which sounds best may be that in which the 8:4 or 10:5 coincident partials are closer to matched than are the 6:3 pair. Tests appropriate for these wider octaves are the focus of this lesson.

The challenge of tuning the low bass is that we have so many choices, and sometimes, especially with smaller pianos, no good ones! Once we decide by listening what width octave works best (or offends the least), we can use the appropriate octave test in parallel fashion (PACE Tuning Lesson #18) to gain consistency in our tuning.

How to tune a pure 8:4 octave

A pure 8:4 octave is one in which the eighth partial of the lower note is the same pitch as the fourth partial of the upper note. The 8:4 coincident partial pair is located at the triple octave above the lower note. First, simply play the octave. As you sustain it, lightly play (but do not sustain) the note a triple octave above the lower note. The triple octave note should aurally focus your attention on the 8:4 beats, if present. Listen closely to that pitch and the changing beat rates there as you move the lower octave note slightly up and down. Refresh your aural focus by touching the triple octave as needed.

Now try the principal 8:4 octave test, which is the m6-M3 test. This is a fifth partial test, which means the note a m6 above the lower octave note and a M3 below the upper has its fifth partial in common (close enough to create beats) with the eighth partial of the lower note and the fourth partial of the upper. We will thus test an 8:5 m6 against a 5:4 M3, comparing beats at the pitch level of the triple octave above the lower octave note. Beats in these intervals in the low bass may be difficult to hear, so it usually helps to use a ghosting technique. Hold the m6 and then the M3 keys down silently in turn, (left index finger on test note, rock between little finger and thumb on octave notes) and with each silent interval strike a forte, staccato blow on the triple octave note. Listen for and compare the faint "ghost" beats of the m6 and M3. Since the m6 is a contracted interval (like the m3) and the M3 is expanded, judge your results as follows:

If m6 > M3, the 8:4 octave is narrow (lower note sharp). If m6 = M3, the 8:4 octave is pure. If m6 < M3, the 8:4 octave is wide (lower note flat).

Example 1: 8:4 octave tuning

Tune A1 as a beatless 8:4 octave to A2, aurally focusing on the beats at the A4 level by lightly touching A4 as you play the octave. Test as follows:

1. Silently depress the m6, A1-F2, strike A4, and listen for the m6 beats; then silently depress the M3, F2-A2, strike A4, and listen for the M3 beats.
2. Compare the m6 and M3 beats. If the m6 is the same speed as the M3, you have tuned an 8:4 octave from A1-A2. If the m6 is faster, go to step 3. If the m6 is slower, go to step 4.
3. If the m6 is faster, the octave is narrow. Lower A1 slightly and re-test (go to step 1).
4. If the m6 is slower, the octave is wide. Raise A1 slightly and re-test (go to step 1).

How to tune a pure 10:5 octave

A pure 10:5 octave is one in which the tenth partial of the lower note is the same pitch as the fifth partial of the upper note. The 10:5 coincident partial pair is located at the triple octave-third (M24) above the lower note. First, simply play the octave. As you sustain it, lightly play (but do not sustain) the note a M24 above the lower note. This should aurally focus your attention on the 10:5 beats, if present. Listen closely to that pitch as you

move the lower octave note slightly up and down, noting the changing beat rate; refresh your aural focus as needed by touching the M24 again.

Now try the M24-M17 test for a 10:5 octave. This is a first partial test, which means the note a M24 above the lower octave note and a M17 above the upper has its first partial in common (close enough to create beats) with the tenth partial of the lower note and the fifth partial of the upper. We will test a 10:1 M24 against a 5:1 M17, comparing beats at the fundamental pitch level of the test note, a triple octave-third above the lower octave note. Beats in these intervals in the low bass are usually easy to hear, and a direct comparison of beat rates is all that's needed. Since both the M24 and M17 are expanded intervals, you should judge your results as follows:

If M24 < M17, the 10:5 octave is narrow (lower note sharp). If M24 = M17, the 10:5 tuning is pure. If M24 > M17, the 10:5 octave is wide (lower note flat).

Example 2: 10:5 octave tuning

Tune C1 as a beatless 10:5 octave to C2, aurally focusing on the beats at the E4 level by lightly touching E4 as you play the octave. Test as follows:

1. Play the M24, C1-E4, and the M17, C2-E4, and listen to the beats at the E4 level.
2. Compare the M24 and M17 beat rates. If the M24 is the same speed as the M17, you have tuned a 10:5 octave from C1-C2. If the M24 is faster, go to step 3. If the M24 is slower, go to step 4.
3. If the M24 is faster, the octave is wide. Raise C1 slightly and re-test (go to step 1).
4. If the M24 is slower, the octave is narrow. Lower C1 slightly and re-test (go to step 1).

Additional 8:4 and 10:5 octave tests are listed at the end of the lesson.

Chapter meeting set-up

These lessons are most conveniently taught to a small group of four or five. Each group should have its own piano and RPT instructor. Each piano should be in a quiet environment for close listening. Avoid using pianos that present serious obstacles to tuning, such as deeply grooved or misaligned hammers, string termination noises, etc.

A 7' or larger grand piano is preferable for this lesson, since it will be more likely to accommodate 8:4 or 10:5 octaves in the low bass. You can conduct this lesson on smaller pianos, but the 8:4 and 10:5 octaves probably won't sound as good as they would on the larger pianos. If both small and large pianos are available, you can use one of each and compare the bass tuning response characteristics of each piano to various octave types, thus adding an optional extra dimension to the lesson.

An RPT should prepare each piano for this lesson in advance by ensuring it has a good tuning that is ready for nitpicking, muted to single strings from the midrange down.

Tools & materials participants must bring

Tuning hammer (required), mutes and Coleman Beat Locator (optional).

Home study assignment for participants

Study two articles in the May, 1990 *Journal*: "The Bass" by Rick Baldassin, pages 22-25; "Learning to Pass the PTG Tuning Exam, Part VI: Bass," by Michael Travis, pages 32-37 (also in "The PTG Tuning Examination: A Source Book").

Try tuning 8:4 and 10:5 octaves in the low bass on your practice piano, and compare the results to those you would get from a 6:3 tuning, or any other method you might use. Use the examples above as a guide.

General instructions

The instructor should demonstrate a test on several low bass octaves by having participants listen critically to a number of octaves using the test, and then have them practice tuning two or three octaves each. First perform the m6-M3 ghosting test for 8:4 octaves as described above in parallel fashion on several octaves starting at the A1-A2 octave and proceeding down. Make sure everyone is focused on the beats at the strike tone level. See if you can hear the test interval beats without a strike tone. Sometimes playing the test intervals softly enables this. Get participants to interpret what they hear as wide, narrow or pure 8:4 octaves. Each participant should then tune two or three bass octaves as pure 8:4 octaves (m6 = M3). When everyone is finished, play the parallel series of 8:4 octaves and discuss whether they sound acceptable.

Repeat the process with 10:5 octaves. First perform the M24-M17 test as described above in parallel fashion on several octaves starting at the A1-A2 octave and proceeding down. Make sure everyone is focused on the 10:5 beats. Get participants to interpret what they hear as wide, narrow or pure 10:5 octaves. Each participant should then tune two or three bass octaves as pure 10:5 octaves (M24 = M17). When everyone is finished, play the parallel series of 10:5 octaves and discuss whether they sound acceptable.

Finally, tune several of the lowest octaves without interval tests so that everyone agrees that they sound as beatless as possible, and then perform 6:3, 8:4 and 10:5 tests to see what width of octave seems to work best on the piano at hand. Repeat with several upper bass octaves. See if you can confirm the statement that wider octaves generally sound better in the low bass.

See "If Time Permits..." on the following page

Note: *Do you find these lesson plans valuable? Do you have specific suggestions for changes or clarification? Please direct any comments or suggestions to the author c/o the* Journal.

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If Time Permits...

If extra time remains, you may want to try these other "equal-beating" tests; most are mainly of academic interest, but may be useful on some pianos. For the sake of completion, the tests featured in this lesson are included. Remember that the superscript in the test name refers to the interval's coincident partial level and means you must use a ghosting technique to hear the correct set of beats. Use a sostenuto to silently sustain wider intervals for ghosting. If beat rates are too slow to hear, you can adjust the test note appropriately for a comfortable beat rate (this is an interesting exercise, but not practical!). On M2 intervals: the 9:8 M2 beats too slowly to be useful for the low bass, while the 10:9 and 8:7 M2s have limited usefulness only in the low bass, being too fast everywhere else.

8:4 Octave Tests

P11-P4, a third partial test (example: C1-F2, C2-F2, ghosted with strike tone at C4) using 8:3 P11 vs. 4:3 P4. Note: slow-beating test intervals.

m6-M3, a fifth partial test (example: C1-G#1, G#1-C2, ghosted with strike tone at C4) using 8:5 m6 vs. 5:4 M3. (Preferred)

$P4^2$-$P5^2$, a sixth partial test (example: C1-F1, F1-C2, ghosted with strike tone C4) using 8:6 P4 vs. 6:4 P5. Note: slow-beating test intervals.

M2-m7, a seventh partial test (example: C1-D1, D1-C2, ghosted with strike tone C4) using 8:7 M2 vs. 7:4 m7.

$M2^2$-M9, a ninth partial test (example: C2-A#1, A#1-C3, ghosted with strike tone C5) using 9:8 M2 vs. 9:4 M9. Note: slow-beating test intervals in low bass.

10:5 Octave Tests

M24-M17, a first partial test (example: C1-E4, C2-E4), using 10:1 M24 vs. 5:1 M17. (Preferred)

$M17^2$-M10, a second partial test (example: C1-E3, C2-E3, ghosted with strike tone E4) using 10:2 M17 vs. 5:2 M10.

M13-M6, a third partial test (example: C1-A2, C2-A2, ghosted with strike tone E4) using 10:3 M13 vs. 5:3 M6.

$M10^2$-M3, a fourth partial test (example: C1-E2, C2-E2, ghosted with strike tone E4) using 10:4 M10 vs. 5:4 M3.

$M6^2$-m3, a sixth partial test (example: C1-A1, A1-C2, ghosted with strike tone E4) using 10:6 M6 vs. 6:5 m3.

$A4^2$-d5, a seventh partial test (example: C1-F#1, F#1-C2, ghosted with strike tone E4) using 10:7 A4 (augmented fourth) vs. 7:5 d5 (diminished fifth). An interesting test, since both test intervals are the same width.

$M3^3$-m6, an eighth partial test (example: C1-E1, E1-C2, ghosted with strike tone E4) using 10:8 M3 vs. 8:5 m6 test.

$M2^3$-$m7^2$, a ninth partial test (example: C1-D1, D1-C2, ghosted with strike tone E4) using 10:9 M2 vs. 9:5 m7. Note: M2 wide, m7 narrow at these levels.

Our Changing Environment: What Do We Do About It? — *Part I*

Beverly Kim, RPT • Member, Marketing Committee

This series is intended to create an awareness of how the changing environment in our communities and in the piano profession/music industry affect us as individuals, as entrepreneurs and as an association. More importantly, we hope to open the doors for further discussions and reflection as to how we will not only respond to change, but manage our own courses toward a successful and productive future. Let's begin with some not-too-unrealistic situations.

Scenario I

John Doe has been around for a long time and is known as a solid, respectable piano tuner. He's a good aural tuner, not one of those gizmo/electronic wimp types. His daughter has joined him in the profession, making the business a family enterprise. She's a recent RPT, uses an electronic tuning machine, laptop computer, cellular phone — you get the picture. They expected to make more money by sharing shop space, major shop equipment and supplies. But instead, the two technicians were so very different that they didn't work well together. They spent so much time in power struggles, arguments about business practices, expenses and investments, that they didn't service their customers as well as they'd planned.

Scenario II

A piano manufacturer has a policy of promoting from within. When the company started, its work force came from the local community, which was mostly white second- or third-generation Scandinavian families; thus the current supervisors are mostly white men in their 50s. The current work force is still drawn from the local area but the demographics have changed and there are now large Southeast Asian and African-American populations in the community. Supervisors have tried to get new employees to do things the "right" way, and no one can figure out why productivity is so low.

Scenario III

A new PTG chapter was formed as a result of restructuring, combining members from three smaller chapters. For a time, there was harmony. But before long, individual members began to push for traditions and practices that they experienced in their own chapters. Various practices were at odds with each other and with the broad jurisdiction concept. Some members felt that the new chapter was tilted too much toward one particular chapter's practices. In the resulting tension, many technicians left the PTG.

Scenario IV

A good RPT has been in business for 5 years in a suburban community. During the past few years, there was been a significant change in the population mix, which resulted in a minority population of almost 15% — an increase of 200% in the past decade. A review of customer files indicates that almost 98% are of the white majority population. The RPT begins to wonder..."What does this population shift mean to my business/What can I do with this information?"

Marketing Ourselves

These situations are fictional, and yet there is one common thread: the people who make up the population of the scenarios are different from one another. They are also similar in some respects and there is no doubt that many lessons can be learned from their experiences and background, but it is their differences with which we are concerned.

Some of these differences are easy to identify, for they are visible right on the surface: individuals are male or female, young or old, majority or minority. Other differences are not so easy to see: education level, life-style, goals and ambitions, sexual orientation, personal values and belief systems involving loyalty and commitment, ways of thinking, respect or fear of new ideas, etc. We don't immediately see people's individual styles or challenging authority, entrepreneurial spirit or teamwork. These differences and many more comprise the diversity of our society.

The differences have always existed in America. There are tremendous differences among and within all of our racial/ethnic groups. Socio-economic conditions can change overnight as a result of lay-offs, mergers, divorce, death or hurricanes. Religious and spiritual beliefs, and the freedom of choice has been a foundation of this country. Military experience, geographical influences, family structure and political philosophy add to the mix. Physical abilities/disabilities vary amongst us, although we are all susceptible to the aging process. Many of these factors give us diversity within our own families.

"So what?" you ask. This isn't an article about political correctness. It's the beginning of a dialogue about the need for us to acknowledge the differences that exist in our lives and to explore ways to enhance our business practices because of these differences. We must recognize the ways in which people of different backgrounds and experiences can enrich our client pool and our lives.

Next month, we'll address some of the trends and changes in our society which may alter the way we view our service role and our businesses.

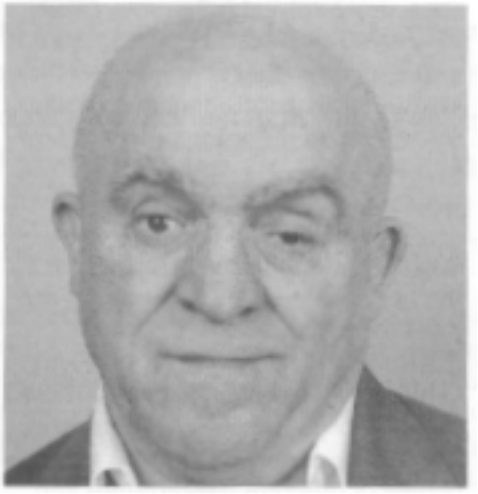
PTG Review
PIANO TECHNICIANS GUILD
Dedicated To PTG News • Interests & Organizational Activities

Passages

Jack W. Sprinkle, RPT
Aug. 21, 1932
Jan. 25, 1995

Jack W. Sprinkle, 62, died January 25, 1995. Being a charter member of the Piano Technicians Guild was his greatest joy. He served as President of the Washington, DC, Chapter of the American Society of Piano Technicians before it merged with the National Association of Piano Tuners to become PTG. He was the youngest member of the organization at that time, 26 years of age. After the formation of PTG, Jack served in many capacities through the years. He was an Examiner for several years, serving both locally and nationally. He was one of the two technicians who started the private tutoring program at the Annual Conventions. Jack also served on many committees, taught classes, and was elected Southeast Regional Vice President for two years. He attended many state seminars and missed only a few Annual Conventions, traveling into all of the 48 contiguous states. His favorite pastime at these functions was getting together with fellow technicians, instructors, friends, sharing experiences, ideas, having a drink or two, and proudly sharing his home-made beer. And until recent years, he was easily recognized by the cigars he loved to smoke.

Jack was the Steinway Concert Technician servicing pianos for Steinway artists at the DAR Constitution Hall in Washington, DC, for 13 years and the White House pianos for seven or eight years, becoming known to all of his PTG friends as "The White House Tuner." During these years one of Jack's outstanding memories was when Rubinstein brought a new Hamburg Steinway Piano from Germany for a concert tour and he was the first to tune it.



Jack Sprinkle, RPT

Once he learned a person's voice, he always would recognize that person the next time they met, always giving a challenge to recognition ability which he seldom missed.

Jack was the recipient of the Hall Of Fame Award and the Member Of Note Award.

When the time came when it became difficult for him and some others to attend the much-loved meetings of the Washington, DC, Chapter, he instigated the formation of the Northern Virginia Chapter, receiving the charter in 1973, and serving as its President for two years.

Through the years he gathered many, many friends and was very proud of his Craftsman rating in PTG. He was a true Craftsman.

We wish to thank all of you for your prayers, encouragement, and love we received throughout Jack's illness and transition. He enjoyed hearing from all of you.

Jewel Sprinkle

Kenneth H. Gentry, RPT
Oct. 16, 1928
Dec. 25, 1994

Christmas 1994 was saddened by the loss of our dear friend and fellow technician, Kenneth H. Gentry. He died from respiratory complications at 3:30 Christmas morning. Ken was 66

Continued on next page

No One Will Fill The Void...

Jack Sprinkle will live forever in the hearts and memories of many people. His accomplishments and honors are many in PTG. I remember him as my first tuning instructor in a tuning class in Wichita in 1961 — and hearing him many times since.

His tuning concerts were the highlight of several conventions, and yes, I'll miss that stinkin' pipe. Lue's and my sympathies are extended to Jewel and all his family. Another of my concerns is for the people who didn't know him and were never under his influence. They missed a lot.

And who will take his place? Someone who will be around to sit in Council, teach, or just be fun to be around? No one will fill the void left by his passing.

Ernie Preuitt

years old. He had been a musician and tuner-technician in Shreveport, LA, since 1953.

We all called on Ken for advice and assistance and he was always willing to help. Many of our members worked under his leadership from time to time. We also used his shop to conduct many of our chapter meetings. His kindness and abilities to tackle any situation will be sadly missed.

Ken is survived by his wife of 32 years, five children, two sisters and four brothers.

Gary Neie

Walter Olson, RPT
May 19, 1913
Dec. 19, 1994

Walter Olson, one of the founding members of the Rogue Valley, OR, Chapter, died Monday December 19, at his home in Medford, OR.

He was born May 19, 1913, in Union County, SD. On April 15, 1936, at Hawarden, IA, he married Iva Ann Henderson, who survives. They moved to the Rogue Valley from Hawarden in 1955. He was a piano technician in southern Oregon and northern California from 1955 until he retired in 1992.

Survivors include a daughter, Mary Ann Olson, Central Point; six sons, Ronald, Central Point; Larry, of Eagle Point; Marvin and Dennis, both of Medford; Rodney, of Ft. Collins, CO; and Garry, of Hudson, FL; a sister, Carolina Smith, of Jacksonville; 15 grandchildren and 14 great-grandchildren.

In Memory...

William Carpenter
Chicago, IL

Stanley Johnson, RPT
Maine

Bernard Misbin, RPT
New Jersey

Robert Trader, RPT
Detroit-Windsor, MI

William Young, RPT
Portland, OR

Reclassifications To RPT

REGION 6

901 LOS ANGELES, CA

MARK A. STERN
216 S. OAKHURST DRIVE
BEVERLY HILLS CA 90212

REGION 7

981 SEATTLE, WA

JOSEPH F. ALKANA
P.O. BOX 337
NORTH BEND WA 98045

New Members In December

REGION 1

031- NEW HAMPSHIRE

SCOTT N. CRAMER
230 MAIN STREET
LITTLETON, NH 03561

NEIL A. ROSENBERG
60 PLAIN ROAD
HOLLIS, NH 03049

REGION 2

201- WASHINGTON, DC

GEORGE L. WHITE
930 WINTERHAVEN DRIVE
GAMBRILLS, MD 21054

275- RESEARCH TRIANGLE, NC

WILLIAM C. BYNUM
2519 CEDRONELLA RD.
CHAPEL HILL, NC 27514

301- ATLANTA, GA

GORDON P. BRYANT
61 CEDAR LANE, N.
NEWNAN, GA 30263

THOMAS F. MARCOTTE
439 WAYWARD WING DR.
LILBURN, GA 30247

GAYLE MONTELIN
3057 S. OLA ROAD
LOCUST GROVE, GA 30248

PAUL F. WELLBORN
752 STEEPLE CHASE DR.
LAWRENCEVILLE, GA 30244

327- CENTRAL FLORIDA

DANIEL J. BERG
506 LAKE BRIDGE LN. #1028
APOPKA FL 32703

LAWRENCE H. KLAR
411 BREVARD AVENUE
COCOA FL 32922

334- PALM BEACH, FL

ALAN F. HARDCASTLE
22258 SW 66TH AVENUE
BOCA RATON, FL 33428

REGION 5

551- MINNESOTA - NORTH IOWA

MARK W. FLEMING
404 MADISON ST.
P. O. BOX 1
FLOYD, IA 50435

REGION 6

921- SAN DIEGO, CA

JOHN R. ADAM
5150 FOOTHILL BLVD.
SAN DIEGO, CA 92109

956- SACRAMENTO VALLEY, CA

BROOKS WEISMAN
1141 LAUREL STREET
NAPA, CA 94559

REGION 7

001- CALGARY, AB

STEVE SHU
1347 12TH AVE., SW
CALGARY, AB T3C 0P6
CANADA

830- IDAHO WEST

ERIC M. LEATHA
514 WARM SPRINGS AVE.
BOISE, ID 83712

Introducing (Belatedly) Exam Pre-Screening

Publisher's Note: You may have seen recent articles about the new Pre-Screening Manual produced by the Examination and Test Standards Committee. You may have wondered what pre-screening means and why we need a manual for it. Your confusion is undoubtedly due to the fact that a series of articles written by Mitch Kiel, ETS Chair, to introduce the manual appeared out of sequence. With apologies to Mitch and to you, therefore, we present the first article in the series, which should have appeared in our December issue.

Movin' On Up!

Mitch Kiel, RPT • ETS Chair

The Examinations and Test Standards Committee is pleased to announce a new PTG publication called the Pre-Screening Manual. This month's column will introduce pre-screening and preview the Pre-Screening Manual.

Some history

During the 1970s and '80s, dedicated members of PTG created and refined new RPT exams. In the first half of the 1990s, PTG realized that improvements in education were needed to support those higher standards.

Pre-screening is the link between education and the exams.

What is pre-screening?

Pre-screening is a voluntary non-regulated assessment of an examinee's ability to pass any of the three RPT exams (written, technical, or tuning).

No PTG bylaws or regulation have been created or altered because of pre-screening. There is no PTG requirement that an applicant get pre-screened, nor that an applicant pass a pre-screening test before taking the RPT exams.

The results of a pre-screening session should be confidential, just like the RPT exams.

Pre-screening is not a new concept. It's occurred for years. Every time an Associate asks an RPT, "Hey, got a minute? I'd like you to listen to one of my tunings," that's pre-screening.

The Pre-Screening Manual is a reference source for centralizing, improving, and promoting pre-screening.

Who can administer a pre-screening?

Anyone at all. A pre-screener does not have to be a CTE or technical test examiner. RPTs can (and should) give pre-screenings. Examiners already have enough to do.

Why should an examinee get pre-screened?

1. to learn
2. to increase the chances of passing the RPT exams
3. to save everyone's time

Why should an RPT be a pre-screener?

1. to encourage Associates to upgrade and thereby strengthen the ranks of RPTs
2. to become (re)acquainted with the newest RPT standard
3. to support PTG and our many devoted examiners
4. because to teach is to learn
5. as a tribute to whomever helped you when you were starting out

Pre-screening session goals

The goal of a pre-screening session is to help Associates judge if their skills are advanced enough to pass the RPT exams. Pre-screening is a more efficient method for doing this than taking an exam multiple times.

You — the Associate — are the beneficiary of this exploration. Pre-screening should give you a sense of where you stand on the preparedness path. If you're near the beginning, you should come away from a pre-screening session with a detailed map of your educational needs. If pre-screening shows you already know a lot, you'll gain confidence for applying for the RPT exams.

Either way, the success rate for all eventual examinees should increase.

How pre-screening differs from an actual exam

Pre-screening is just a tool for predicting success on the RPT exam. Like other predictors (the weather forecast, fortune cookies, Chicken Little), pre-screening is not infallible. ETS will continue to refine pre-screening to increase its efficiency and accuracy.

For most pre-screening methods detailed in the Pre-Screening Manual, there is no numerical score. Instead, the result is usually in the form of a positive/negative recommendation of exam readiness.

Who benefits from pre-screening?

Everyone everywhere every time:

Associates

Pre-screening helps you find out if you're ready to take the RPT tests, and saves wear and tear on your wallet, confidence, and composure.

Pre-screening is a great way to reduce the test anxiety that's the downfall of so many adrenaline-laced heart-stompin' wild-eyed examinees.

Understanding what you know and don't know is important. It gives you a perspective on yourself and your abilities. And with all the learning tools now available, it's not hard to fill in the gaps.

RPTs

Over the years, the RPT exams have become more objective, more sophisticated, and more difficult. As a proud professional and role model for Associates, you owe it to yourself to stay aware of and to support PTG's evolving standard — the RPT exam.

If you upgraded before 1988, you may not be familiar with the latest version of the exams. Re-taking the exam is one way to find out how much it's been improved. Another is to become an examiner or assistant.

Pre-screening is a third option. It gives you the benefits of participation in the exam process but requires less of your time and energy.

Presently, most pre-screeners are examiners. This is neither necessary nor advisable. If more RPTs get involved in pre-screening, examiners would be able to concentrate on what they're trained for: administering the RPT exams.

As education continues to improve and pre-screening becomes more widespread, the number of Associates taking the RPT exam is sure to increase, and examiners' workloads will increase commensurably. Therefore, it's doubly important that RPTs become pre-screeners.

Examiners

You're the workhorses without whom the RPT exams would be meaningless words on a page. By increasing an applicant's chance of passing at the first attempt, pre-screening makes more efficient use of our busy and devoted pool of examiners.

Examiners' responsibilities on test day include helping the examinee get comfortable and ensuring he/she understands test procedure. An applicant who's properly pre-screened is calmer, already familiar with time limits and scoring, more likely to exhibit his/her true abilities, and to pass (an examiner's best reward).

PTG

PTG past-President Fern Henry said it best in her introduction to the PACE checklist:

Developing the exams and training examiners to administer them involved countless hours of work by hundreds of individuals, with the result that improved skills and understanding of piano technology permeated the entire organization via examiners, examinees, and anyone else exposed to the process. Thus the RPT exams have advanced—and continue to ad-

EVENTS CALENDAR

All seminars, conferences, conventions and events listed here are approved PTG activities.

Chapters and regions wishing to have their function listed must complete a seminar request form. To obtain one of these forms, contact PTG Home Office or your Regional Vice President.

Once approval is given and your request form reaches Home Office, your event will be listed through the month in which it is to take place.

Deadline to be included in the Events Calendar is at least 45 days before the publication date, however, once the request is approved, it will automatically be included in the next available issue.

March 21 - 23
Pacific Northwest Conference
Vancouver, BC
Contact: Paul Brown
749 West 66th Avenue
Vancouver, BC V6P 2R4
604-321-7357

March 30 - April 2
Pennsylvania State Convention
Ramada Inn-Wilkes-Barre, PA
Contact: Earl Orcutt
141 Fort Street
Forty Fort, PA 18704
717-287-0940

April 8
East Tennessee One-Day Seminar
Heritage Music Company, Knoxville, TN
Contact: Jim Ellis
114 West Newkirk Lane
Oak Ridge, TN 37830
615-483-9534

April 21 - 23
Florida State Seminar
Orlando, FL
Contact: Robert Carr
320 West Rich Avenue
Deland, FL 32720-4120
904-736-0551

April 22
Tuning Historical Temperaments
Boulder, CO
Contact: Frank French
P.O. Box 4034
Boulder, CO 80303
303-499-9150

April 27 - 30
NEECSO
White River Junction, VT
Contact: Ed Hilbert
40 Pleasant Street
Bristol, VT 05443
802-453-3743

May 5 - 7
Central West Regional
St. Louis, MO
Contact: Ken Jones
42 Cynthia Court
Florissant, MO 63061
314-839-1220

May 12 - 13
Utah Intermountain Seminar
Snowbird Ski & Summer Resort
Salt Lake City, UT
Contact: Dennis Fife
70 So. Orchard Drive
North Salt Lake, UT 84054
801-292-4441

July 19 - 23
PTG 38th Annual Convention
& Technical Institute
Hyatt Regency / Albuquerque, NM
Contact: PTG Home Office
816-753-7747

vance—the state of the art of piano technology by their very development and existence, as well as through individual upgrades.

This is PTG's contribution to our craft. It is a worthy contribution that benefits piano technicians as well as the world of music... By participating in the examination process you are lending support to PTG's goal of advancing piano technology. You are then a participant, and not just an observer, and directly add to our continuing progress.

Can we keep personal bias out of pre-screening?

Maybe, maybe not. At the very least, we can try to recognize and minimize it.

Because pre-screening is informal and unregulated, it's impossible for ETS to oversee every pre-screening session or impose rules that prevent unfairness.

Instead, the challenge is to bravely accept human fallibility, and appeal to everyone's integrity and honor.

How can personal bias be minimized?

1. A good start is to be realistic about the limited importance of pre-screening. Pre-screening is just a prediction. It's a finger in the wind, a guess, a probability. Doing well on a pre-screening does not guarantee passing scores on the exam. Conversely, receiving thumbs down does not prevent anyone from signing up for the exam and passing it.
   Remember: PTG bylaws are the rules that govern procedures for taking the RPT exam, and there is no mention of pre-screening. The decision when to take the exam always resides with the Associate.
2. Another way to minimize bias is to have competent pre-screeners. The Pre-Screening Manual can help, by offering many effective pre-screening tools and methods. Some methods are described in great detail; one reason for doing so is to leave less room for personal prejudice and less excuse for incompetence.
3. An examining body (chapter, area examining board, etc.) could appoint a pre-screening chairman. That person can monitor pre-screeners' effectiveness, handle complaints, and be a source for pre-screening referrals. Some examining bodies might go so far as to create their own Pre-Screening Program, with designated pre-screeners, required pre-screener training, standardized procedures, published guidelines, regular oversight, etc. The Southern California Area Examining Board is at the forefront of this type of effort.
4. Pre-screener and Associate have the right to decline to participate if either suspects personal bias — their own or another's — might be a problem. This implies that, when a pre-screening session is mutually agreed upon, both parties have promised to be trusting and trustworthy. After a pre-screening session, if an Associate feels the pre-screener was incompetent or biased, the Associate is free to ignore the recommendation.
5. If an examining body has a formal pre-screening program, rotating assignments might help. For example, person A is appointed chapter pre-screener for six months, then person B pre-screens for the next six months, etc.

An array of pre-screening methods

Remember college final exams? That's the RPT exam.

Remember pop quizzes, math books with the answers in the back, being called on in class? That's pre-screening.

Pre-screening can occur many times and in may different ways before an RPT exam. Early in their education, Associates benefit most from mini pre-screenings. Later, as their skills become more complete, they're better able to reap the benefits of a complete pre-screening.

Therefore, the Pre-Screening Manual provides many different methods. Some take as little as three minutes, some an entire day.

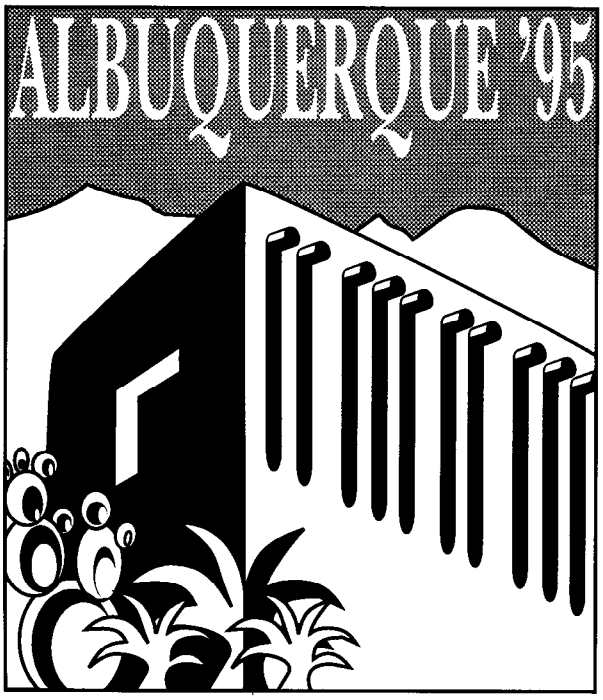
We all know it's important to use the right tool for the right job. For pre-screening, this means you should choose the pre-screening method best suited for your specific situation.

Consider:

- *the stated need of the Associate*
  An Associate might want to get a perspective on his/her ability in only one area. (How's my tuning stability? What does a one-point unison error sound like? Will this splice pass?)
- *time availability*
  A pre-screener might not be able to spare a half day to give a full-blown mock exam. Rather than let the Associate languish, find a half hour to listen to a piano they've already tuned. Better something than nothing.
- *the readiness level of the Associate*
  The Pre-Screening Manual contains numerous pre-screening methods for Associates with all levels of experience. Some are very detailed, with lists of questions and correct answers. Other pre-screening methods are flexible, and begin with short tests of basic ability, proceeding to more advanced tests only if the Associate demonstrates competence with these basic skills. Otherwise, the pre-screening session ends.
- *proximity of exam day*
  As exam day approaches, choose a method that mimics exam standards, time limits, and panic. The mock exam is the ultimate example of this type of pre-screening.
- *availability of qualified local people*
  Some chapters have few experienced examiners or pre-screeners. This may be due to chapter size, isolation, or dependency on large chapters elsewhere. There are pre-screening methods specifically designed for RPTs with minimal exam knowledge and Associates with no qualified RPTs nearby.
- *availability of exam-quality pianos or jigs*
  What do you have to work with? Are there any large grands available for practice? Has the chapter's action model been lost for decades?

I'm an Associate. Can I pre-screen myself?

No, not really. You can — and should — read all the educational material now available to prepare for the RPT exams (Source Books, PACE checklist, PACE lessons in the *Journal*, etc.), but there's no substitute for being pre-screened by an experienced RPT, especially as exam time approaches.



International Flavor... ...Southwestern Spice

PTG's 38th Annual Convention & Institute
July 19-23, 1995 • Albuquerque, NM

IAPBT's International Conference
July 21-24 • Albuquerque, NM

Global Warming Is Real Think Green—Act Green!

Fred Fornwalt, RPT
Institute Director

For years scientists have debated and news agencies have reported on the existence of global warming and its effects. Satellites have even been used in the search for global warming — definitive proof of global warming and its effects will be present in Albuquerque in July of 1995, as hundreds of piano technicians come together from all parts of the world, and exchange friendly handshakes and warm greetings.

After spending the better part of a week discussing and learning more about pianos — exchanging ideas and touring the scenic Southwest — the effects are sure to be long-lasting.

As individual practitioners in a global piano industry we owe it to ourselves, our customers and the piano industry to be part of this international event.

As small business owners we also have the responsibility to think and act green. For any business to be successful it must be efficient and profitable — it must have a healthy cash flow.

Once again, the place to be is Albuquerque July 19 - 23: to learn the latest techniques; to learn efficient business practice; to be inspired, encouraged and supported by other successful technicians. Your business can be greener if you invest in yourself.

PS. Make your competition green with envy — make your reservations for Albuquerque today !!!

1995 Class Highlights

Computers — The Tuner's Other Keyboard - Ron Berry
A practical review of computers; software and on-line services for the piano technician.

How to Build and Sustain a Business — Keith Kopp
Principles for operating a successful business, from a teacher who has done so.

Marketing and More — Evelyn Smith
How to attract the customers and piano work you want through marketing.

Keytop Replacement — Dave Betts
Techniques and jigs to do the job right.

Removing the Snake Oil from Grand Dampers — Richard Davenport
A comprehensive class that demystifies the grand damper system.

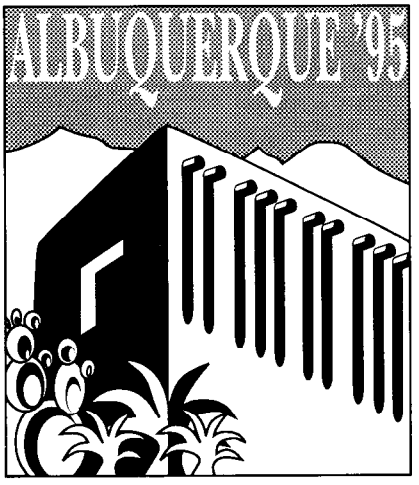
Setting Up Your Shop — Edward (Ted) Sambell
Shop layout and organization — includes health and safety equipment.

International Instructors Featured In Albuquerque Technical Institute

Wally Brooks, RPT
Institute Committee

This year's Institute and Convention will be held in conjunction with the International Association of Piano Builders and Technicians (IAPBT), making this convention truly international in scope.

This Institute will include several highly noted international instructors. Here are some of the highlights of these classes:



- From **Scotland**, we have **Harry Lyddall**, who will give a class titled "Tuning with a British Flavour." Harry has extensive experience as a concert technician for Harrod's and for Bluthner in London. He has been an instructor at The London College of Furniture and at present is at Stevenson College in Edinburgh, Scotland. He also is the mentor of our own Ray Chandler.
- **Norbert Abel** from the **Abel Piano Hammer Company** in **Germany** will present "Construction and Manufacture of Piano Hammers." Learn about the preparations and components used in manufacturing piano hammers, how hammers come into being, and making custom hammers for antique pianos, from the manager of Helmut Abel GMBH, one of the finest hammer manufacturers.
- **Max Matthias**, the president of **Euro-Piano**, will present a class on the **Russian** piano industry in history and as it is today: "The Musical Life in Russia and the Standard of the Trade." Max is from **Germany** and has an extensive background in the piano industry, having been employed by or as a consultant for over 40 years to Kluge Keyboards, Baldwin, Bechstein and Steinway in both New York and Hamburg.
- **Fazioli Piano Company** of **Italy** is sending over their chief master technician, **Henier Sanwald**, to give a class on "European Soundboard Design." Henier has an extensive education from Germany as a master piano and harpsichord maker.
- From **Norway, Odd Aanstad** will present two classes on early pianos. In the first, titled "The Early Piano, Evolution and Progression," Odd will explain through slides the progression of the piano, including scaling, frames and actions up to 1860, from a piano technician's point of view. His second class is "Maintenance and Restoration of Early Keyboard Instruments," what sorts of materials to use, scaling, stringing, types of wood, varnish and glues. Odd is a factory-trained piano technician and has worked as an independent techni-

Continued on next page

Conquistadores and Penitentes — The Spanish in New Mexico

Fred Sturm, RPT
Host Chapter Chair

New Mexico is a very Spanish state. Spanish is recognized as one of the two official languages in the state constitution, along with English, and Hispanic influences can be seen everywhere, from food to names to architecture to cultural quirks.

The first Spanish explorers came to New Mexico in the early 1500s, searching for legendary cities of gold. In all likelihood, the native Mexican peoples they interrogated in their quest for riches made up stories of rich cities "farther on in that direction" in an attempt to get rid of those strange invaders. More than once, Indian guides tried to lose the Spanish by leading them long distances into the vast open plains of the west.

In the end, the Spanish had to be satisfied with the relatively poor cities of the Pueblo people, and though they hadn't found the riches they sought, they decided to establish settlements in the area we now know as New Mexico. They found some mineral deposits and did some mining, but for the most part, they eventually became farmers. Official Spanish policy called for native Indian people to be treated with respect and allowed to live in their traditional villages, although missionary priests were to work to convert them to Catholicism. In spite of official policy, the Pueblo people were subjugated by force and often maltreated by the Spanish, and many villages declined into ruin from famine and disease, but over time, a unique blended culture came into being.

The Spanish settlements in New Mexico, centered in Santa Fe, were very remote from the central government in Mexico City, and virtually their only contact with the outside world came with the twice-yearly pack trains along the "Camino Real," or Royal Road, between the two cities. In this isolated existence, the Spanish adopted many Indian ways, including flat-roofed adobe houses, irrigation systems and certain crops, including corn. The Indians in turn borrowed from the Spanish such things as wheat, domesticated animals, chile (brought by the Spanish from Mexico), and the outward forms of Christianity (though they retained their own religious practices, literally underground, in their religious gathering rooms known as "kivas," which are usually built underground.

The Spanish settlers were for the most part deeply religious people. The isolation and lack of sufficient priests led them to form religious brotherhoods to maintain their religious traditions when priests were not available. These brotherhoods were known as the "Penitentes," and their most important and famous activity was the annual reenact-

Continued on next page

Technicians Harmonize At The Top Of Texas

The Texas State Association of PTG convened at the Sheraton by the Falls October 27-30 for an exciting seminar on the banks of the Wichita River. One hundred and 10 folks arrived from as far away as California and Michigan to participate in technical classes, the first-ever TSA Golf Tournament and spouse tour.

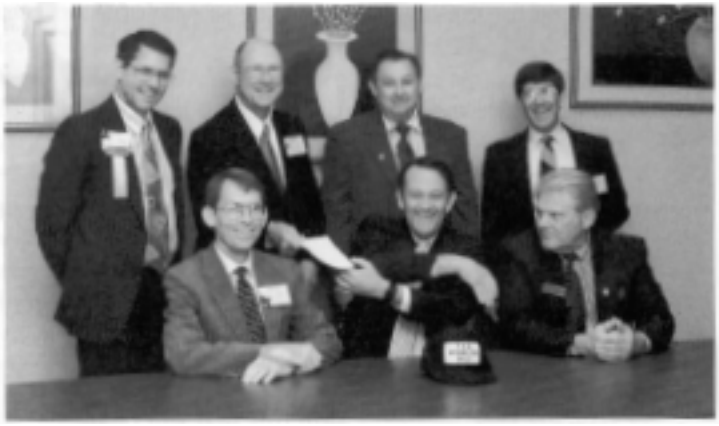
Classes were held on all aspects of piano technology from basic to advanced, in classroom style and "hands-on." The golfers enjoyed a beautiful Thursday afternoon on the links at Weeks Park. Saturday, the spouses gathered for lunch and a style show in the Barron's Club, then bused to Sikes Senter for three hours of fun. TSA also donated over $1,000 in scholarships and booth presence to the Texas Music Teachers' Association at their annual convention in Houston.

At both the banquet and the business meeting, the untimely passing of Danny Boone, RPT, was recognized. Danny was a vital member of both PTG and TSA and we will miss him. PTG President Leon Speir, RVP Bob Johnson, Jim Geiger, and Martin Wisenbaker remembered Danny as a friend and fellow officer.

At the banquet on Saturday night, Jimmy Gold, RPT, was honored with a plaque for the work he has done for both TSA and PTG. Many felt it was a high point of the seminar as Jimmy is much loved here. Jimmy and Dean Baker provided music before the banquet and were joined by other members after. Past PTG Presidents Kelly Ward and Fern Henry were present with their spouses, Carroll Ward and Bill Spurlock.

Thanks to Baldwin Piano and Kent Webb; Kawai Piano and Ray Chandler, Pianotek and Bob Marinelli, Spurlock Specialty Tools and Bill Spurlock, Fern Henry, Gary Neie, Willem Blees, and Bernard Mollberg, who were Institute Instructors. Thanks to Thom Tomko for conducting the PACE Academy, assisted by Leon Speir, Walt Connell, Dan Reed, Robin Hufford, David Reed, Doug Parsons, Bill Spurlock, Fern Henry and Joe Tom McDonald. Thanks to Jack Wyatt, Joe Tom McDonald, Ramon Ramirez, Robin Hufford, Dan Reed, Jim Geiger, Craig Waldrop, Wim Blees, Doug Parsons, Peter Collora, Walt Connell, Jimmy Gold, Tex Reed and Keith McGavern, who were mini-tech instructors. And thanks to all who attended and made the TSA successful.

Dale Probst



TSA golfers relive the thrills of the first TSA Tournament. Sitting, from left: Claude Harding, Wim Blees and Bob Johnson. Standing, from left: Leon Speir, Dean Baker, Jack Wyatt and Kraig Gilliam

Spanish...

ment of the crucifixion, sometimes with somebody actually nailed to a cross. In small Hispanic villages, Penitente brotherhoods are still active, though they have become more secretive and tend to avoid the public spotlight.

Santa Fe, built in the early 1600s, is the best place for a visitor to get a taste of the Hispanic tradition in New Mexico. A stringent building code limits most buildings to the old style: flat roofs and stucco walls, to look like houses built of "adobes" (mud bricks baked in the sun, laid in courses with mud between them, and plastered, usually every year, with mud). Santa Fe has narrow streets, a wonderful plaza where Indians sell their wares, many art galleries and shops which cater to tourists, along with old churches, historic buildings and a variety of museums.

If you can't make it to Santa Fe, "Old Town" in Albuquerque, founded in 1708, can provide a substitute on a small scale. It has an old mission-style church and a plaza surrounded by restaurants and shops filled with Indian and Mexican handicrafts and other tourist-oriented wares.

Spanish and Indian influences are pervasive throughout New Mexico. There is no place like it in the United States, or probably in the world. In my next article, I'll write about the "Wild West" and some of the later history of New Mexico.

International Instructors...

cian for over 30 years. Restoration of historical instruments has been his specialty for the past 20 years.

- **Nikolaus Schimmel** of the **Schimmel Piano Company** of **Germany** will give us a complete history of the piano in "The Evolution of the Pianoforte: History from Stick-zither to Modern Grands and Uprights." Special emphasis will be on the evolution of the sound-producing portion and the action and key assemblies. Nickolaus has an extensive background in piano building, servicing and concert tuning for over 40 years (a member of PTG for 37 years) and has been CEO of Schimmel since 1961. Nickolaus has a newly published book on piano history.
- **Steinway & Sons** will have a representative from their **Hamburg** plant in their class, and **Yamaha** will have a technician from **Japan** in their piano preparation class.

It's not often that you will get a chance to see these international instructors along with the top-flight American instructors. If you have not made plans for Albuquerque, I think it's time. Don't miss this one!

AUXILIARY EXCHANGE

Dedicated To Auxiliary News and Interests

Making Plans...

It's time to make your plans for July. The convention this year will be in Albuquerque, NM. This year will be an international convention, something very unusual. The International Association of Piano Builders and Technicians (IAPBT) will be joining the PTG this year in Albuquerque for a joint convention. The PTG Convention will start at the regularly scheduled times, and the IAPBT will continue on Monday. There will be plenty of new faces from far-away places and opportunities to make new friends from around the world. You certainly won't want to miss this one.

In this year's Auxiliary schedule, you will find more free time for shopping than ever before, with a tour to a destination voted the most popular place to go by the International Travel Agents: Santa Fe. This is one of the great artists' capitals of the world.

The scholarship store is still open. Please consult the page to your right and do the right thing: ORDER NOW! Proceeds from the scholarship fund will be used to expand our scholarship effort and in promoting the Guild throughout the music industry, which is one of our main purposes for existing. As a member, I am asking you to do your part and to promote the scholarship store.

Should you have any comments or suggestions on how to make this association work better for you, or to make it more enjoyable for yourself or others, please do not hesitate to contact me directly. This organization is here for you.

— L. Paul Cook

...And Setting Goals

Did you make any New Years' Resolutions? Are they now firmly entrenched in your daily life or , like the majority of those who make silent promises to themselves on the eve of the new year, are they forgotten and nothing more than a fleeting memory? Our good intentions, particularly when they involve doing something for ourselves, tend to last a very short time. It is only human to get caught up in the flow of daily activities and forget that we had promised ourselves that this year we were definitely going to get up a little earlier every morning and take a walk around the block, or were going to set aside 30 minutes of each day for quiet time. Perhaps your resolve had a focus on losing weight or quitting smoking. You wanted to do something for yourself and thought that the new year would give you the incentive to make a change in your life.

I learned long ago that if I had a completion date for a task, be it large or small, I was better able to focus on my immediate intention and thereby accomplish what I wanted to do. Perhaps if your resolution was "I want to lose 10 pounds," or, "I want to quit smoking," or whatever, you might have resolved at the stroke of midnight on December 31st, you should add "by July 19th." That would give you four whole months from now to accomplish a goal you set for yourself and when you arrive in Albuquerque on July 19th for the PTG Convention, you can tell everyone that your resolution was achieved.

Those of you who set your will to achieve a goal and then go forward and work at it hour by hour and day by day deserve the praise of those who just talk about their wishes and never get started on attaining them. It takes determination, strength of mind and many times, self-denial, to accomplish our dreams and it is NEVER too late to move in a forward direction toward the goal.

A few years ago, I attended a workshop about building positive attitudes and life skills and came away with a few appropriate tips that are worthy of sharing. The speaker said that goals are: *what you want to be, where you want to go, what you want to do and what you want to have.* Statistics indicate that you have a greater chance of achieving a goal if it is written down, so be sure to

post your goals in a visible place where you will be able to observe them and be reminded of what you plan to achieve.

Remember, it is never too late to make changes within yourself and the time to start is NOW. Make one good resolution, set a date of completion and write it down. Can't wait to see you in Albuquerque and hear about what your have accomplished.

— Shirley M. Erbsmehl

Publisher's Note: Because of changes in the way we produce the Journal *in the Home Office, the entire "Auxiliary Exchange" was omitted from the January issue. We apologize for the delay in bringing you PTGA news.*

In Memory Of Esther Stegeman

Once again we have lost another branch on that wonderful tree of friendship. Esther Stegeman, age 85, died January 11, 1995. She had been diagnosed as having ALS (Lou Gehrig's disease). Esther was a loyal and willing worker for the Piano Technicians Guild Auxiliary for many years, having served as secretary for four years and president for two years. She generously gave of her time and effort to further the growth of this organization.

Esther enjoyed music and was a piano teacher for 65 years. Her many students benefited from the correct techniques she insisted they learn. Her attention to detail was also very much evident in the beautiful beadwork, tatting and crocheting she did. She took pleasure in teaching others how to do some of these things and was patient with some of us with less nimble fingers.

She is survived by her husband, Bill, four children, 10 grandchildren, two great granddaughters, three brothers and one sister.

We are glad to have so many pleasant memories of Esther. She touched all our lives in many different ways. We will miss her warm and loving friendship.

Don and Marie Miller

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Closing date for placing ads is six weeks prior to the month of publication.

Ads appearing in this publication are not necessarily an endorsement of the services or products listed.

Send check or money order (U.S. funds, please) made payable to Piano Technicians Journal, 3930 Washington, Kansas City, MO 64111-2963.

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DISPLAY AD INDEX

The PianoDiscussions
March 1995

News From The World Of PianoDisc

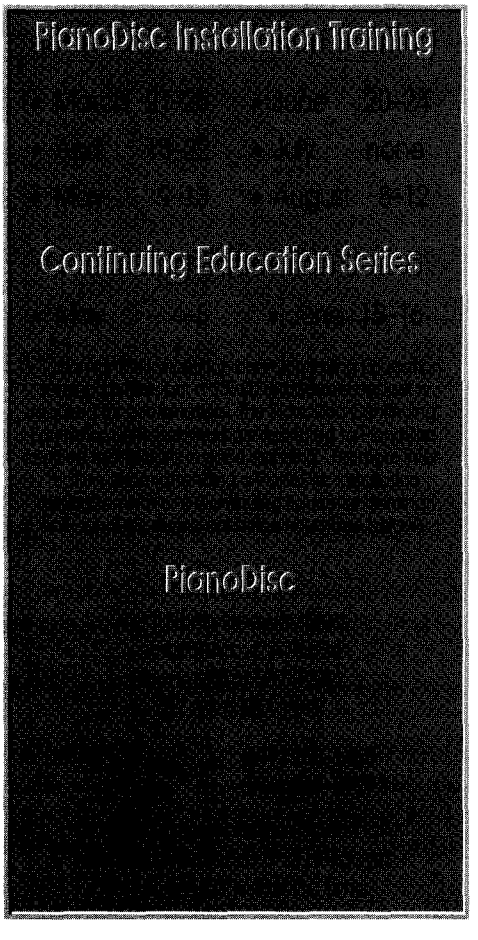
Hot NAMM - what a show!!!

This was, without a doubt, our biggest NAMM show ever. We had more products, a larger booth and more traffic than ever before!

"Despite the disastrous floods that threatened our Factory and World Headquarters only days before, NAMM preparations went off without a hitch, and we had our best show yet," said a PianoDisc official. "We demonstrated our newest products and most exciting innovations, and dealers from around the world were literally cheering!"

Among the highlights of PianoDisc's four day exhibition at NAMM:

• A hilarious PianoVideo™ featuring the most famous artist to perform for PianoDisc to date, Bugs Bunny! "Bugs stopped more traffic than O.J.", says a PianoDisc official. Through PianoDisc's advanced PianoVideo technology thousands of NAMM attendees watched Bugs Bunny trying to perform a piano concert while a pesky mouse tries to horn in on the act. "People were glued to our booth, waiting for Floyd Cramer to finish so that they could see Bugs again," says the official. "They loved Floyd too, but they couldn't get enough of that waskally wabbit."



• The unveiling of the PianoCD library, with over 30 new compact discs, several with LIVE accompaniment. "Many dealers were surprised to learn that ours is the only full expression CD system on the market," says a PianoDisc representative. "While other systems may only support 15 levels of individual expression, our PianoCD supports over 120 levels. It's an 800%+ improvement in resolution over previous CD products. Also, ALL of the discs in the PianoCD library are full-expression performances, unlike others on the market."

• The premiere of QuietTime, PianoDisc's 100% acoustic/electronic piano hybrid. As one of PianoDisc's demonstrators explained, "This patented system allows a pianist to play their own piano and listen to either the actual instrument or a high quality sampled grand sound through a set of headphones. And it's retrofittable to virtually any piano." QuietTime was also looked at closely by MIDI musicians, eager to explore the benefits of using their own piano as a MIDI controller.

• PianoDisc's new sister division Music Systems Research hit the ground running, unveiling their entry in the highly competitive speaker/amplifier market. "Our Impact Series powered speakers are shielded, which allows use not only with the PianoDisc system, but also with your home computer, electronic music equipment, and many other products," says a member of MSR's development team. "They're a significant value. That's probably why they got as much attention as they did."

• Our new PianoDisc piano furniture models got a lot of attention, particularly the latest verticals. "There are now dozens of decorator model and color combinations available", says a PianoDisc account exec.

Also distributed were souvenir pens, copies of the new Artist Series poster (featuring Floyd Cramer, Peter Nero and others), and a NAMM issue music catalog. "We issued a special catalog for NAMM so that dealers can see how far we've come in the last year," said a PianoDisc official. "We'll be issuing yet another catalog this spring, this one with even more listings!"

Steve Allen records for PianoDisc

Entertainer extraordinaire Steve Allen recently made the trip up to Sacramento, joining an already illustrious roster of artists who have had their performances immortalized by PianoDisc.

Many remember Steve Allen as the original host of the "Tonight Show", long before Johnny Carson or Lantern Jaw Leno. "Steve Allen created the 'Tonight Show' format while David Letterman was in diapers", says one PianoDisc music editor. "He is articulate, witty, and a pretty impressive musician to boot."

In fact, Steve Allen is as prolific a songwriter as he is a television and movie performer, with literally hundreds of songs to his credit. His PianoDisc recording features several of his hits, including the theme from "Picnic" and his signature song, "This Could Be the Start of Something Big".

"We were delighted to host Mr. Allen, and even more delighted with the music he left with us", said one PianoDisc official. "We're sure everyone will enjoy this music as much as we enjoyed listening to Mr. Allen perform it. Think of it. Steve Allen playing YOUR piano!"

Mr. Allen also posed for a portrait with a PianoDisc piano, contributing his image as well as his music to the success of PianoDisc. Mr. Allen's PianoDiskette will be released July 1.

YAMAHA PIANO

Silent

SERIES

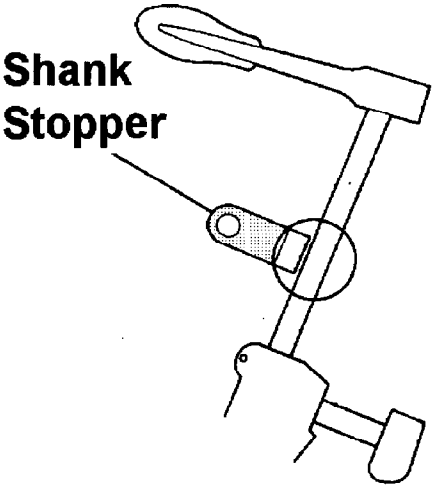
Yamaha's Other "Four in One Piano"

You are already acquainted with the Disklavier as Yamaha's original 4 in 1 piano. Now meet Yamaha's *other* 4 in 1 piano—THE SILENT SERIES PIANO.

1. It is a Traditional Acoustic Piano. Everything you can do on a regular traditional piano, from practicing piano lessons to playing in Carnegie Hall can be done on a Silent Series piano. All of the electronic components that have been added to the Silent Series to make it different, are completely transparent to the musician when playing the piano in it's traditional mode. Nothing interferes with the touch and tone.

2. It is a Silent Piano. Press the center pedal down, and a "shank stopper" is activated inside the action. Each key of the piano still feels the same to the pianist, but the strings are never touched by the hammers. The piano is silent!

A sensing system detects precise key and pedal movement, sending the information to an on-board tone module where a sampled Yamaha CFIII Concert Grand sound is made available to the two headphone jacks. Now, whatever music is being played on the keys is heard only in the headphones!



3. It is an Amplified Piano. By connecting audio leads from the piano directly to an amplifier and speakers, volume can be increased or the sound sent to another room.

4. It is a *real* PIANO KEYBOARD that is MIDI capable. The one thing missing from all electronic keyboards is the true piano touch found only on real pianos, and all Silent Series pianos are real pianos. The MIDI out port allows Silent Series pianos to be connected to a computer, sequencer, tone module, or any other MIDI device. For example, in the case of small churches, a Yamaha Silent Piano, equipped with a tone module can become the church organ or any other instrument in the tone generator — from harpsichord to string section. And of course, it is always a traditional piano.

Now available in Yamaha consoles, studios, uprights, and even in grands. More details next month.

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