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Editorial Perspective

Hegel and the Volvo

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

This editorial had its genesis some time ago, as I sat waiting for a traffic light. I noticed a bumper sticker on the aging Volvo ahead of me, reading something like: "Thinking Green ... Saving our Planet." I thought, now that's really wonderful. I applaud these people for wanting to do something good for the environment. Just then the light changed, and the Volvo lurched forward, spewing a dark cloud of exhaust fumes, and nearly asphyxiating me and the three drivers behind me. This is what your college English professor would have referred to as "irony."

There are some people I just don't understand. A partial list:

1. Drivers of poisonous old cars sporting environmentalist stickers;
2. People who ruin public and private property with graffiti and other vandalism.
3. Piano technicians who don't take their profession seriously enough to join the Guild, and work to improve both their own skills and the profession as a whole;
4. Republicans;
5. Just about anyone who has a different opinion than mine on just about anything.

Now that I'm utterly exposed as an opinionated bigot, allow me to exonerate myself. As you must know by now, I've opened the *Journal* to different points of view. I recognize that we all have our opinions, and that none of us is right all the time. My philosophy is that we can continue learning only as long as we open our eyes and ears to what others have to say. Then, by carefully weighing these other opinions objectively, considering our own experiences, and trying to understand the other person's viewpoint, we can emerge with a synthesized view that incorporates our own opinion as blended with and built upon by the experiences of others. My brother, who has an actual degree in philosophy, tells me that this process is called Hegelian dialectic. Hegel, a 19th-century philosopher, described a dialectic as the process whereby one idea, the thesis, is confronted by an opposing idea, the antithesis. The resulting discussion and argument produce the synthesis, or the new idea that is a product of the dialectic.

In the pages of this issue, you will see reactions to articles which have appeared previously. You will see replies to these reactions. I hope you'll read and consider these articles and letters carefully, drawing your own conclusions. Then, let us hear from you.

I know that each one of us has very real reasons for his or her opinions. If you and I disagree about something, I should be looking first of all to understand your position as clearly as possible. Next, I should try to understand exactly why you believe what you do. Once I really understand what you're saying, and why you're saying it; then we should try the process the other way, with you trying to understand me. In all honesty, I know the driver of the Volvo probably would have had some explanation for the apparent irony of her behavior. We just didn't have time to talk.

All the old clichés hold true here, and I won't bore you with them. But think of the progress we as technicians can make in the coming years, if only we can keep the flow of information and, yes, collegial disagreement, running long enough and with enough good will to reshape the way we approach our work.

Limerick Contest update: The winners of the PTJ Limerick Contest will be announced, and their limericks published, in the September issue.

Although we promised the resumption of Dan Franklin's series on duplex scale tuning this month, production and layout difficulties have made it necessary to delay the series until next month.

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COLUMNS & COMMENTS

DEPARTMENTS

IN ADDITION

COVER ART

Arranged on the cover are a few of the more common tools used by technicians to verify or measure downbearing. John Hartman's series on the subject begins in this issue.

Long-Range Planning Needs Member Input

PTG President
Leon Speir, RPT

Well, it's happened again! PTG has survived another Annual Convention and Council. I wish I could say to you that it was an overwhelming success, but I can't! I wish I could say that Council passed *good* rules for PTG, but I can't! I wish I could say all the Board meetings went well, but I can't! Of course, if I were writing this *after* the Convention, then I probably could say all those things. Because deadlines for the *Journal* are what they are, I have to write this before the Convention, and I just don't know *now* what happened *then*, but I'll bet an overriding theme for the coming year will be ***long-range planning***!

Long-range planning, or a ***five-year plan*** as it's called by some, is a process for doing just what the title implies, ***planning.*** Proper planning is done by first establishing specific goals and then setting priorities for them. Goal setting requires us to define who we are as an organization. In order to work, the goals must be reasonable; they must be achievable and, most of all, these goals must come from *you* the membership. Advisory groups will be formed, or identified, which will each have the responsibility to look at specific areas within PTG in which we need to establish goals. These advisory groups will work with the entire membership to make recommendations in areas of education, marketing, the testing program, board development, organizational structure, subordinate bodies, the annual convention, and others.

The *Members Needs Assessment Survey* that was concluded in March 1993 provided the Board with clear guidelines for moving forward with programs and policies to meet member needs at that time. Programs were developed as a direct result of the survey. The PACE program, increased emphasis on the *Journal,* an increased number of publications made available, and availability of the logo for use by all members are all products of the survey results. This year another survey will likely be needed to evaluate existing programs and to identify current needs to aid in establishing specific goals.

Once goals are identified and priorities are established, the road map must then be drawn which will guide us. Professional assistance is vital to identifying goals and drafting a successful plan to achieve them. The job of the professional will be to advise PTG on how to accomplish long-range planning and to help identify areas of need. It is you the ***members***, however, who must do the actual planning. PTG has a rich tradition as a ***member-driven*** organization. Long-range planning must hold to this tradition. It should be a busy and exciting year ahead.

Rear Duplex Tuning

I was disappointed to read "A Tuner's 10-year Tonal Treasure Hunt" by Dan Franklin in my May issue of the *Journal.* I feel that the article is technically unsound, misleading and overblown. From a technical point of view, a number of problems are apparent to me. The use of patent literature to support a theory is questionable. Descriptions contained in the Steinway patents are at best an unreliable source of technical information. In order to lay claim to an innovation, a technical-sounding explanation had to be given. Either because they didn't know how the innovation worked or because they wanted to confuse the competition, the patent descriptions are unclear and often misleading. Another issue is the support Mr. Franklin gives to his argument through the use of a frequency analyzer. Gathering useful data with this machine requires the application of numerous control procedures including control samples, special acoustical environments, psychological controls and a mechanical control for playing the note. Even if these steps are taken, interpreting the graphs requires considerable experience. Graphs that appear greatly dissimilar can sound the same to our ears, while those that are practically the same in appearance, can sound quite different.

My own experience with tuning duplex scales convinces me that the improvements achieved are ineffectual and transitory. Moving the scales on a Steinway will only achieve consonance on a few notes, and even these notes are only marginally changed. If there is an improved sustain or tone in the notes, it is only a fraction of the improvement possible with standard voicing. Indeed, even adjusting the unison tuning has more of an impact. Any attempt to tune a duplex scale is undermined by the fact that subsequent tunings in the usual manner will not maintain the relationship between the speaking length and the duplex section. Friction at the bridge is too great to allow for even pressure in both sections.

The main problem I have with Mr. Franklin's article is not whether tuning the duplex scales works or has a place in our bag of tricks, but the relative value of this process in the context of piano service and repair. Mr. Franklin makes it sound, by both the tone of the article as well as its length, as though tuning the duplex scales is one of the most important issues for achieving quality results. I would have preferred to see this material in a briefer form or in context within a voicing article.

—John Hartman, RPT

For those who are Steinway buffs to the nth degree and haven't read the May 1995 *Journal* article, "A Tuner's 10-Year Tonal Treasure Hunt, Part I: A Duplex Scale Odyssey," by Dan Franklin is pretty exciting stuff. Mr. Franklin has a unique and fresh way of expressing his experiences. It struck a chord way down deep inside of me.

— Keith McGavern, RPT

[Franklin's article] made a great story, and I wanted to believe as much as anyone else that a great secret was on the verge of discovery. But it was one big false alarm. In the last week I have tried every Steinway which I thought great sounding to find an accord between the speaking length and the back duplex. In each instance (allow me the irony of quoting), "the intervals were somewhat flat or sharp of these consonances."

I suspect, further, that this well-known variation in accordance is likely due as much to the ebb and flow of tensions across the bridge, over the years of tuning, as to any misplacement of the back duplex bars. Anyhow, shouldn't the proper placement and later verification of these bars be a simple matter of distance ratio? Throughout Mr. Franklin's quest there is the unwavering presumption of his that some correct consonance between these two sections will allow the tone of a piano to soar forth. Accompanying this presumption is precious little science. What, may I ask, are we to gather from the charts at the top of p. 26? That partial strength actually deteriorates after "placement and tuning."

Don't misunderstand me, I'm grateful to Franklin for his contribution to the *Journal,* and I admire his zeal. But the best news I got from his article was that LaGuardia Community College has the Steinway Archives Collection, which is by now cataloged. (Could they post an index on the Internet?) But in the meantime, hopes raised in the article's first paragraphs for some dog Steinways up here, are now back on the shelf in their shoebox.

— Bill Ballard, RPT

I have long ago decided that there is no "The Secret," but rather lots of little secrets that must be done well to make the piano sound great. The problem with the pursuit of "One Important Step" is that it deters us from the task of taking care of all the little things that make a piano great.

— Dave Porritt, RPT

Dan Franklin replies:

Don't be too quick to push me and the Duplex off the plank, or to jump in and end it all. Technical support is on the way.

Humidity Control

Del Fandrich's article in the February *Journal* on Tuning Stability in pianos is right on the mark. It is absolutely the best piece I have read on this subject as it puts into proper perspective the fit of humidity changes with the other causes for tuning instability. It's obvious he has done a lot of work in this area and has good insight as a result. I expect I will use this article with some frequency as the occasions arise in the future.

There is one point, however, that is bothersome to me and, at the risk of beating a dead horse, let me air it again. Del would control the environment surrounding the piano as a first choice for providing humidity control to the piano. While this is a solution in some areas of the country, it is not a solution in other areas. The only really acceptable solution in these other areas is to climate control the piano itself. This means using a Dampp-Chaser system and, of course, being

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associated with Dampp-Chaser, I have an axe to grind. While this is true, I'm concerned about doing the right thing.

What I'm talking about is if it's one's intent to bring up the humidity level in the piano room during the cold months, then all of the humidifier manufacturers and retailers and the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) should provide very specific instructions to urge that the humidity level one should attempt to attain be limited when outside temperatures are below 30° F. They are universal in this regard and say that humidity levels above the following should not be attempted, given the following corresponding outdoor temperature levels:

Outdoor Temperature Degrees F.	*OK Humidity Level % RH*
+30	40
+20	35
+10	30
0	25
-10	20

If the 40 percent RH is to be maintained in the winter so that the RH spread from winter to summer is minimized, then it really needs to be done within the piano itself. Of course there are exceptions, the obvious being where temperatures don't go below 30° F or don't do it long enough for moisture to condense and freeze within the wall. The most significant other exception is in newer homes where a moisture barrier (plastic sheet) has been added to the wall during construction.

I venture to say that the vast majority of the homes in this country don't see consistent humidity levels or humidity levels less than 60 percent RH during the normal air-conditioning period. This excludes homes in the southwest where the objective is to bring the humidity level up during the warm months.

My concern is having us, as responsible members of the piano profession, recommend to someone to humidify his home during the winter to levels higher than the recommendations of the people who really know the home humidification business. I don't like to picture the result of someone trying to pump up his home to 40 percent RH with outside temperatures of 10° F or less.

—Robert W. Mair, President
Dampp-Chaser Electronics Corp.

Del Fandrich replies:

Robert Mair has called my attention to a potential problem that could result from taking part of my article in the February, 1995 *PTJ* on Piano Tuning Stability too literally. Mr. Mair is certainly correct in pointing out that it is not always practical — indeed, often not possible — to humidity-control a room to the degree necessary to protect pianos from possible tuning instability and/or damage due to the normal seasonal variations in outside temperature and humidity in some parts of the country. I should have been more thorough in my treatment of this subject in my article.

Trying to maintain a relative humidity level above these recommended levels can, especially in older homes, cause damage (due to condensation) to walls and furnishings. Relative humidity levels that are too high are usually indicated by fogging windows. Modern homes and buildings with good standard insulation and vapor barriers (i.e., plastic sheeting, or the equivalent, installed during construction) can usually be brought up to relative humidity levels above these levels without problems. Anyone considering humidity-controlling their home or building should consult a reliable heating/ventilating and air-conditioning contractor for recommendations specific to their location and situation before doing so.

Since the generally recommended environment for a piano is in the neighborhood of 65° to 75° F at between 40 percent to 50 percent RH, it is obvious that there is a potential dilemma here. It will often not be practical, perhaps not even possible, to control the environment around the piano adequately by simply adding moisture to the room or even to the entire building. It is also common to find that the piano owner or the building owner is not willing or able to even consider doing so. This is where the value of a Dampp-Chaser system comes in. It can treat the piano as a separate environment and condition the air inside the instrument, or immediately under it in the case of a grand, and provide a level of protection not available any other way.

My reasons for continuing to recommend that the first step of protection be to at least attempt to control the humidity level in the home or building are three-fold:

1) Pianos consist of more than just soundboards. There are also actions and keys, pinblocks, keybeds and ... well, you get the idea. Especially in the case of grand pianos, the Dampp-Chaser systems are most effective in controlling the environment immediately under and around the soundboard area. They are less effective on the other parts; the actions and keys, pinblocks, keybeds and ....

2) Dampp-Chaser systems are not completely effective in grand pianos located in rooms that are heated and/or cooled by forced air heating and cooling systems. Depending on the amount and the velocity of the air being blown about by the HVAC system, the air under and around the piano can be disturbed enough to decrease the Dampp-Chasers' effectiveness to the degree that the piano can once again be at some risk to environmental instability or damage. This risk can, of course, be alleviated by properly locating the piano away from air vents, but again, this is not always possible, practical or desirable.

3) It has been my experience that, in extreme environments, Dampp-Chaser systems cannot by themselves provide enough protection to the entire piano to completely prevent problems related to changing temperature and humidity levels.

In light of the above, my advice continues to be to first attempt to control the overall environment in which the piano resides to whatever level is practical. Failing that — indeed, often in addition to that — use a complete Dampp-Chaser system to provide the final level of protection.

War Stories!

A dealer sent me out to calm a client whose three-month-old Kawai KG-2 had a rattling sound. Two other technicians had looked at it, and so had the client's piano teacher (who proclaimed the soundboard "defective"). The real problem? On leg number one, one of the leg bolts (machine screws) was not tight and the big metal washer was rattling against the leg screw. From that point I learned all over again to double-check all leg and lyre screws.

In a similar situation the source of the rattling sound was the brass leg ferrule on leg number three, and in yet another incident, the noise was coming from loose bench leg ferrules. All these loose ferrules can be tightened by wedging a small nail in between the leg and the ferrule.

Don't even try to tighten the tiny brass nail holding the ferrule. Little nails should be in our tool cases, anyway, for renailing bench bottoms. The majority of piano manufacturers use staples for that purpose.

— Isaac Sadigursky, RPT

Best Bushing for Steinway Pedals

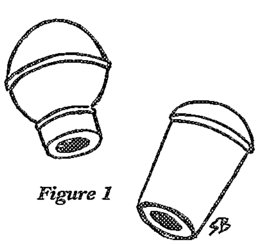

Figure 1

It's common knowledge that the cheap rubber bushings (see Figure 1) wear out too quickly. The best bushing I've found is cut from a piece of fuel injection hose, available at auto supply stores (see Figure 2). If there isn't a piece of leather at the bottom of the pedal rod hole, cut one from hard shoe leather with a 1/2" arch punch (see Figure 3).

— Isaac Sadigursky, RPT

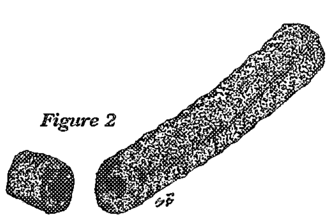

Figure 2

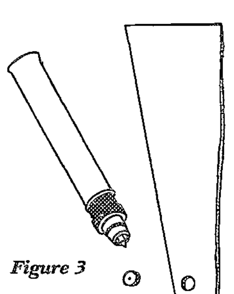

Figure 3

PVC Pipe, Ammonia and ... Panty-Hose?

(Reprinted from The Richmond Update)

In my shop you will find all sorts of oddball assorted gizmos and gadgets to make life easier. One such "invention" is a five-foot section of inch-and-a-half PVC pipe with a cap glued on one end. The other end has an unglued matching end cap with a magic marker stripe to identify it. What does it do? This is my way to prepare long piano hinges for polishing. I remove the loose cap and insert the dirty, nasty hinge into the pipe and pour in soapy ammonia until the hinge is covered, plus a little more. Pop on the end cap and make a quick pass around with duct tape, then set the pipe aside for a couple of hours or so.

Open the taped end and pour off the soapy ammonia and retrieve your hinge. It will not be clean by any stretch of the imagination, but by working on the tarnish with a good brass cleaner and steel wool or Scotchbrite pad your work will be much, much easier. The soapy ammonia loosens the crud and makes polishing brass less of a grind.

Pick up a heavy-duty plastic shoebox and you have a perfect soaking box for pedals and smaller brass parts. Save old pill bottles, as you can put the hinge screws in them along with some soapy ammonia. Use your imagination! I found a three-compartment fishing tackle storage box just right for lid hinges, locks, screws, and assorted small parts. Use one, two, or all three compartments as needed. It only costs about four bucks and change! Soapy ammonia is good for only one shot. Don't try to salvage it for future use; it doesn't have the strength once it has been cycled, and besides, it is cheap enough to replace. Be safety conscious and responsible in disposing of the ammonia. Remember that even though the stuff you get at the supermarket is highly diluted, it is still a chemical that can cause burns, blindness and, if accidentally combined with certain other easily found household chemicals, explosive!

As long as we are cleaning brass, remember that panty-hose make a great cleaning pad. It holds the brass cleaner and is abrasive without being ***abrasive***, if you know what I mean. I use it after the steel wool as sort of a final "finish coat" before buffing and polishing. This usually gets the last of the stuff off so you don't load up your buffing wheels with extra gunk.

— Bob Bartnik, RPT

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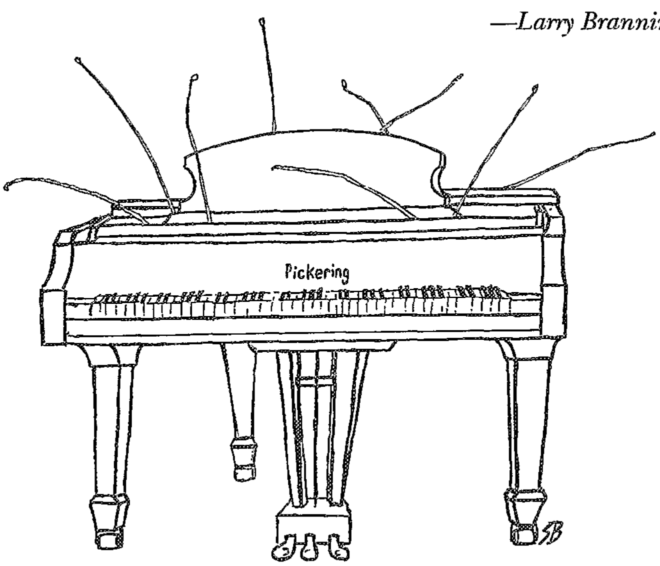
(Editor's note: The following questions and answers were taken from the Internet discussion group, "pianotech.")

Q — *Bass String Breakage*

Has any one besides me had trouble with Samick SG172's breaking bass strings? I had one church that seemed to constantly break them and I dismissed it, thinking they were "just playing too hard." Now I have another and it is doing it, too. I have perhaps replaced as many as 15 strings on each of them. Richard Elrod at Samick has been very kind to send free replacements, but after a while I'm almost afraid to ask again. I feel there may be more to the story, and if anyone has had similar experiences or perhaps a solution, I'd appreciate any help. I have considered lowering the let-off, but this, so far, hasn't seemed to slow the process any. Perhaps they may have some problem with the agraffes? An important detail about the breakage: 99 percent of the time the strings are broken *before* we get there. In other words, we aren't the ones breaking them while tuning; it happens while they are playing. I am sure anyone can hit a key with enough force to do most anything to a piano, but the people in these churches are not concert artists who slam the keybed with the force of an elephant. They *will* hit it rather hard, as the minister says, "when the Spirit moves them." I just feel they are not hitting with any more force than an artist, yet we continue to have the strings being broken between each tuning. I felt that by now these people may have gotten so upset with me that they would call someone else. So far they keep calling me, and I have no answers for them other than to replace the broken strings. Now they are breaking the *new* ones again. Somehow this points to a problem I can't solve. Remember, this is not just one isolated piano, this is happening to me at two different churches, in two areas. Any help?

—*Larry Brannin*



A — *From Scott Thile, RPT*

I think it is interesting that both the pianos Larry is having this problem with are located in churches. I have also worked in the past for churches that had chronic bass string problems. In my cases, these strings were broken at the agraffes, and three different pianos were involved, all grands, a Kimball 5', a Samick around 7', and a Kawai KG-1.

After several months of string breakage, I happened into one of the churches at the end of a rehearsal and observed that the pianist was using the sustain pedal a great deal in combination with very heavy playing in the bass. In short, these bass strings were vibrating extensively and continually during the entire time the piano was being played.

I think what is happening is a combination of string fatigue (heavy playing with heavy use of the sustain pedal), and possibly the final blow being a heavy hammer hit to a string that is already deflected upward in a vibration from a previous blow.

The other factor is the condition of the hammers. I have noticed for some time that significantly grooved and flat hammers (especially if they are also hard) break strings much more than nicely shaped hammers, although I have noticed this more in the capo sections than in the bass.

A — *From Jim Harvey, RPT*

After a while, I believe you'll find this condition not exclusive to Samick, or any other particular brand. Technicians find this a difficult problem to diagnose correctly, since we're usually not around when the pianos are being used.

Larry, you are correct that the player is usually playing no harder than would a concert artist. It is also correct that the pianist, whether young or old, large or small, black, white or orange is irrelevant. See if one or more of the following is accurate in describing your client(s) with the string-breakage problems.

Competition and Egos: In many churches, the piano(s) are tuned only, and then only when they are no longer acceptable with the fixed pitch of the Hammond organ and twin Leslie tone cabinets. The pianist has feelings too, and wants to be heard along with the singers, electric bass and drums. Test: Check for worn pedal surfaces and wobbly, clicking keys on the organ, cracked symbols on the drums, missing cymbals on tamborines, and other signs of parallel (ab)use.

Skill: The pianist has little, if any, musical training, and the songs (regardless of any written music, if used) are played using three or four chords, in usually one, but no more than one of three key signatures. Test: Look around

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the piano for music — if only three hymn books with the same title are found, I'm right. (The books are used to determine how many verses, and in some cases, the words to the songs).

Hammers: The hammers are impacted and/or string-cut. This is not to imply that they still have lots of felt on them, rather where the hammer actually contacts the string. (The last one I saw, the hammers "looked" beautiful through the strings, but had 18 mm cuts across A4). Test: Measure (don't guess) string cuts in center section of piano. My worst case ever was hammers being completely worn out after only six months.

Usage: A concert artist is playing different pianos at different times, over different musical passages, using dynamics, and hopefully on a piano that is well-maintained — not just tuned. A concert artist has also studied the instrument. Your piano(s) have two dynamics — off and loud, and likely the only shiny pedal on your piano(s) is the damper pedal. This is typically used in one of two ways; (1) sit down, press the damper pedal and hold until the song is finished, or (2) use the damper pedal as a metronome. Test: Check the damper travel on each of the offending pianos — likely the travel from the pedal is far greater than specification. Any blocking device or material has usually been impacted (in the case of felt), or driven further into the keybed (screw, capstan, etc.), thereby permitting the damper stop rail to be driven higher than specified.

Playing Style: If there's a name for this style of playing, I'm not aware. However, during certain vocal (or aural) accompaniment, the piano is used as an effects device — in involves holding down the damper pedal (of course) and playing an octave in the bass with the left hand while playing appropriate notes or chords with the right. This way, depending on the length of the prayer, song, chant, point-being-made, etc., two bass strings could receive the equivalent of five or six years of "normal" play. Test: No way. The pianist is usually not your liaison, and if so, will either not play for you, or will not play the same way as during a service.

1. If strings are replaced as they break without doing anything else, these, too, will break in so many blows or so many months. Meanwhile, while playing with, for example, one string of a bichord, and if the client waits for tuning to be the only criterion for service, the other string is becoming fatigued. A cyclic pattern is established.

2. You will not hear this from your clients, but these pianos are replacing others that had the same problem. The string-breakage problems simply became too chronic to not replace the instrument.

3. The former pianos are not from the same manufacturer as the new.

4. You are likely a new tuner/technician to this particular client. They've already tried others in your community — and blamed them for their inability to work the necessary magic to correct the problem.

5. There are those rare individuals who can, with a playing style I cannot duplicate, break a *new* string while you wait. I've only had two clients who could do this, so this can safely be eliminated from the discussion.

6. Only in rare cases would I pursue "bad wire," flexibility, rescaling and other such issues. This problem is primarily under the umbrella of modern high-tension scaling, abuse (the piano doesn't know the difference between willful and unwillful abuse), lack of a regular and proper maintenance regime, and lack of client education.

A — *Barbara Richmond, RPT*

Jim Harvey has hit the nail on the head. Among the string-assassin victims I have serviced have been a Young Chang upright, a Baldwin Hamilton, a Mason & Hamlin A, a Steinway B and a Yamaha G-2. The church who owned the YC had no problem until they started renting out their space to another group. I was amazed how much the piano had changed from one regular service call to the next and asked the secretary who the new pianist was. She thought I was a psychic. After that the strings started to pop. I got called in and tried to explain, gently and tactfully, to the music committee what was happening, and what Young Chang was willing to do about the situation (provide a new set of bass strings, but the church would have to pay to have them installed). One man was so angry about it he screamed at me, calling me among other things, a liar. I picked up my belongings and walked out.

The Yamaha G-2 church consists of much gentler and accepting folks. The pianist is a little old woman with a beehive hairdo. After explaining to them what the problem was and advising them to provide a monitor so the pianist could hear herself (she competes with drums, organ, two bass guitars, and an electric guitar — oh, she doesn't break bass strings — treble wires are her specialty) they shook their heads and said that it would cost an awful lot of money. I said, "Well, at least open up the lid on the piano!" Of course, a few weeks later I got a call from the pianist, who said, "We opened the lid, but a string still broke."

Seriously, I first saw this piano when it was one year old — the string cuts were about 3/4 inch. I shaped the hammers, regulated it to rob it of as much power as possible, put lost motion in the damper pedal, softened what hammer felt was left and managed to slow but not eliminate the breakage. Five years ago (I've been servicing the piano for ten years) it needed new hammers. One day as I worked, the minister was shuffling around and mumbled something like, "thought we wouldn't have this problem if we bought a new piano."

Q — *Water-Based Finishes*

I'd like to ask for comments on your experiences with water-based lacquers. I have sprayed nitrocellulose lacquer for years, but, seeing the government's handwriting on the wall, decided to try these new lacquers. I hate them. Just hate them.

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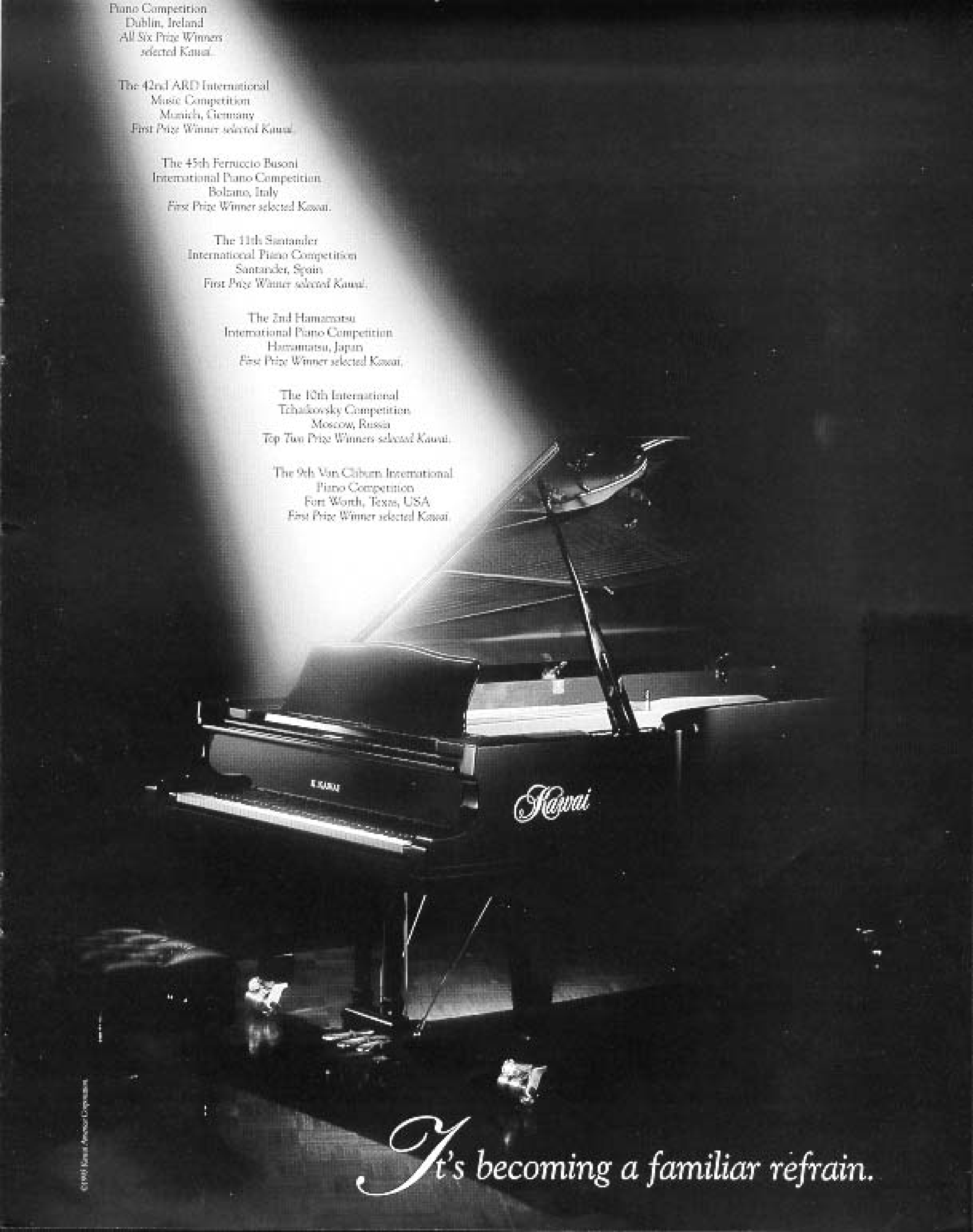

Piano Competition
Dublin, Ireland
All Six Prize Winners
selected Kawai.
The 42nd ARD International
Music Competition
Munich, Germany
First Prize Winner selected Kawai.
The 45th Ferruccio Busoni
International Piano Competition
Bolzano, Italy
First Prize Winner selected Kawai.
The 11th Santander
International Piano Competition
Santander, Spain
First Prize Winner selected Kawai.
The 2nd Hamamatsu
International Piano Competition
Hamamatsu, Japan
First Prize Winner selected Kawai.
The 10th International
Tchaikovsky Competition
Moscow, Russia
Top Two Prize Winners selected Kawai.
The 9th Van Cliburn International
Piano Competition
Fort Worth, Texas, USA
First Prize Winner selected Kawai.
KAWAI
Kawai
It's becoming a familiar refrain.

Continued from Page 16

I'm ready to go back to nitro. If any of you have used or are using water-based, did you achieve the results you wanted or expected? Is there a secret to achieving satisfactory results that I don't know about? I'm getting no help from the manufacturer of the material, and no one else in my area uses it. I am using HVLP spray equipment and, of course, have all the traditional compressors and spray guns. I've just not been happy with the results. Maybe I'm too picky!! Let me know how you have fared ... good or bad.

— Paul Dempsey

A — *From Bill Spurlock, RPT*

I've done a couple of pianos, some furniture, and a few batches of my hammer hanging jigs with Hydrocote water-based lacquer. I tried to stick with it long enough to get comfortable with it, but have since gone back to nitrocellulose. I liked the fast build, low fumes, and non-flammability of Hydrocote. I also found it to be much more durable than nitro. It doesn't show white marks when dinged and, in general, seems tougher and less prone to settling into the grain (grain doesn't reappear after a few months).

However, because it is so flexible it is a bear to sand. It clogs sandpaper constantly, no matter what you lube the paper with. It is also nowhere near as clear as good nitro lacquer, despite the maker's claims. Dip a piece of glass into Hydrocote and one into regular gloss lacquer and let both dry. The Hydrocote piece will look milky. Consequently, the wood looks more like you used a pigment stain (muddy) rather than a dye stain. Another problem was clogging of the spray gun if you didn't clean it out immediately.

There may be hope, though. Water-borne finishes are developing quickly, and I've read about a new version called Hydrocote Equal. It is supposed to have much better clarity, succeeding layers dissolve completely into the last, it won't clog the spray gun, and is much easier to spray evenly. One source is Highland Hardware in Atlanta, 800-241-6748.

A — *From Dennis Johnson, RPT*

I have been using Carver Tripp's water-based sealer and varnish for the past few soundboards, now, and I am pleased with it. I don't bother spraying it on though, as many seem to prefer. I brush it on with a high-quality tapered nylon brush. It dries fast enough that dust is no longer a problem, and the entire finish is done in one day. The finish does look milky, even in the can, but I have found that it dries clear, and they claim that it won't ever yellow.

I don't mean to imply that I have thoroughly researched all brands to endorse this particular one. However, I met some harpsichord builders at an early music festival a couple of years ago who convinced me to try it. I, too, have a problem with fumes, and my shop does not have any windows, let alone adequate ventilation. Carver Tripp is not that hard to find either, I get it at a local quality woodworking store.

A — *From Bill Springer, RPT*

I have done several pianos (including the plates) with Amity brand water-based finish. If care is taken to spray light coats and one can wait long enough between coats, the results are fine. In my opinion, people switching from nitro to water tend to apply the coats too heavily, causing the "milky look." When I first started using the stuff I had these problems, too. On the plus side, because you have more solids the build is much quicker, and the finish is clear. For the final sanding and rubbing out, the finish must be really dry (like two to three days after the last coat). I use Matador brand paper from Germany, which lasts long and cuts very well.

In my opinion nitro is easier to work with and tends to be more forgiving. However, you have the added expense (or not) of setting up your shop, adhering the all the OSHA and fire regulations ... not to mention the potential damage to your own health if proper protection and safety methods are not used.

By the way, a great source for stains, (water-based or not) is W.D. Lockwood in New York, (212)966-4046. They sell powders in any color you could want for water, oil, or alcohol bases.

Q — *Brush vs. Spray*

Can you get the same high-quality finish by painting on the water-based finishes as you can with spray-on? I'm finding it hard to imagine a way to get the finish to go on smoothly and evenly, especially on case sides, carved legs, etc. I have used water-based brushed polyurethane for some home projects (using a nylon brush), but the results kept me from daring to use it on a client's piano. Any tips would be welcome.

—John McKone, RPT

Q&A

A

From Stephen Birkett (fortepiano builder)

Haven't tried it on a piano finish, but ... I refinished an oak table with water-based polyurethane with excellent results. The trick seems to be to avoid frothing as much as possible. Use a very fine quality synthetic brush with v-cut bristles. Pre-soak the brush in water. Don't over-load the brush. Don't wipe the brush on the side of the can. Once the varnish is on don't go over it again ... just leave it. First coat soaks in fast. After that, leave at least a day between coats (in spite of what it says on the can) ... unless you live in the desert. I used five coats, including the first ... looks like a sprayed-on finish. If you want you can rub it down after the last coat ... but wait a few weeks for final curing.

Tips, Tools & Techniques

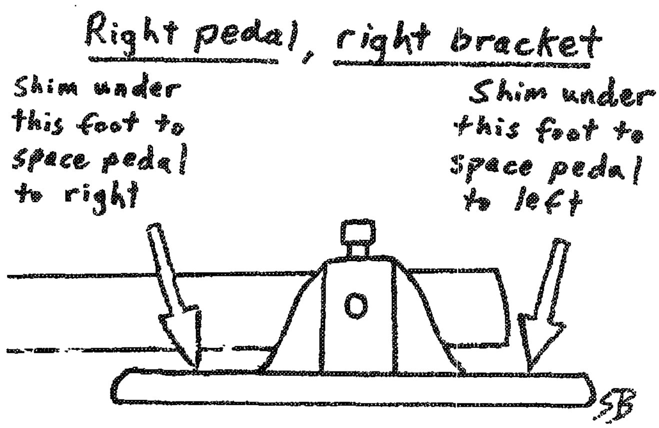
Continued from Page 12

TT&T Handy Way to Align Vertical Piano Pedals

(Reprinted from The Richmond Update)

Pedals on new pianos that rub and scrape on the side wall of the hole in the toe rail through which they protrude are an offense for which the manufacturer should be shaken around the neck. I finally found a way to reduce my unkind thoughts and quickly recenter the pedal in its hole. I'm talking about vertical pianos where the pedal's pin is held in a pair of brackets screwed to the bottom board.

Loosen the screws of a more accessible bracket, say the right bracket of the right pedal. Use cardboard or paper punchings (or other material of suitable thickness) as shims to be inserted under the front or rear foot of the bracket as needed. If the pedal is against the left side of the hole, put the shim under the front foot. Lifting the front foot of the right bracket will move the right end of the pedal pin to the rear, and that in turn moves the pedal to the right in its hole. If the pedal is rubbing the right side of the hole, put the shim under the rear foot of the right bracket. That moves the right end of the pedal pin forward, and that, in turn, moves the pedal to the left in its hole.



I have not yet tried to realign a single pedal where the bracket is the one-piece plastic or metal affair that holds all three pedals. I suspect that the two outside pedals could be re-aligned to a degree by inserting shims under one of the outside corners of the box. The staggered arrangement of the screws holding those boxes to the bottom board makes this a limited option.

— *Dan Bowman, RPT*

The Effects of Downbearing on the Tone of the Piano ... Part 1

By John Hartman, RPT
New York City Chapter

Introduction

Piano factories in the 19th century were organized with strict divisions between management and labor. Management conducted the research, worked on piano design and formulated the work procedures. The craftsworkers on the assembly line were expected to perform the prescribed procedures effectively and efficiently. To do this, they needed simple techniques in the form of "recipes," a sort of shorthand to make their work go faster and simplify their lives. They certainly knew how to do their jobs, but didn't necessarily know why things were done in a particular way. We modern piano technicians have developed our craft in much the same way, relying on procedural recipes instead of learning about fundamental theories and design principals. While these recipes have served us well in the past, we now need a new, more direct approach. This is because our concerns as independent technicians have changed dramatically. Many of us are self-employed with businesses that cover a wide range of services, from tuning and regulating, to replacing soundboards and pin blocks. This new work environment, without the previous barriers between craft and science, requires us to develop a better understanding of the science behind the traditional methods. Learning by recipe may be fast and easy, but is too narrowly focused to allow for the creative solutions we need as independent technicians.

Typically, downbearing is discussed in terms of such recipes and techniques. We know that some bearing is desirable, that a certain amount may be too little or too much, but not what specific effects our recipes will have on the tone. There are many ideas and traditional techniques for applying and measuring bearing, everything from carpet thread and pocket change to sophisticated bubble gauges and dial indicators. Specialized terms are used to describe various aspects of bearing, angular bearing and distance bearing, front and back bearing, side bearing and even negative bearing. All of these ideas and techniques are useful, but without an understanding of the science of downbearing, their true potential will remain unrealized.

Understanding how downbearing works in the piano will broaden your experience in many ways. You will have a better understanding of the true relationship between downbearing and piano tone, and will be equipped to recognize the problems of incorrect bearing with accuracy. Setting bearing as part of your rebuilding process will not be just another repetitive chore but a creative act involving subtle adjustments that enhance the tone. In addition, the science of downbearing will become a powerful tool in the evaluation of any piano being considered for rebuilding or other repairs.

The goal of this article is to answer the following questions: What basic scientific principles do we need to know in order to understand how downbearing works?; What effects on the tone of the piano can we predict from these principles?; How does the amount of bearing affect the tone?; How can adjusting the amount of downbearing help to balance the tone throughout the scale?; and lastly, Why do tonal changes occur when there is a loss of adequate bearing due to the deterioration of the soundboard by aging or other forces?

To answer these questions an understanding of some basic principles of physics are indispensable. I have tried to deliver this information in as simple a way as possible. For the most part I have avoided the use of math and have restricted the use of unfamiliar technical terms. I have found graphs and drawings to be useful devices for visualizing this information and have provided them liberally. For some, this part of the article will be a review of the subject, but for many this information will, for the most part, be new territory. The good news is that your time will be well spent, most of this information is basic and broad enough to be useful in understanding other aspects of the piano.

In structuring this article I have decided to start with broad principles and, later, will show how they apply to the piano. Part one will give you the theory you will need to understand the rest of the article. Part two will draw some general conclusions about how downbearing functions in the piano and how the tone of the piano is altered by the amount of downbearing. In the third part we will discuss some specific applications, using the background theory developed in part one, aimed at achieving balance throughout the scale. I will also include some tips on tone evaluation and rebuilding. The fourth and final part will give specific suggestions for setting bearing; showing how applying the theory can enhance the results of stringing and soundboard replacement.

Simple Harmonic Motion

One of the important acoustical principles that we will consider is the relationship between a body's elastic properties and its mass when subjected to a force that disrupts its equilibrium. This is called simple harmonic motion and can be effectively demonstrated with the following model (See Illustration 1). A mass (M) riding on a cart without friction in its wheels is connected to a wall with a spring (S). This arrangement is in equilibrium, there is no tension or compression of the spring at position 0. When the cart with its mass is pulled to the right to position +1 and released, the spring pulls the cart back past the 0 position to -1, an equal distance in the opposite direction. If there is no friction or other way for energy to leave the system, the cart will indefinitely oscillate between the +1 and -1 positions. This is known as simple harmonic motion. The energy given to the system by pulling the cart to the right is continually passing from the kinetic energy of the moving mass to the potential energy of the spring. One round trip is called a cycle. The number of cycles the cart completes within a given time (usually a second) is called frequency (expressed in cycles per second or hertz). If the mass remains the same and the spring is stiffened, the frequency will increase. On the other hand, if the spring is unchanged and the mass increases, the cart will travel back and forth more slowly. The formula for the frequency is:

$$\text{Frequency} = \text{sq rt} \frac{\text{Stiffness of the spring}}{\text{Mass}}$$

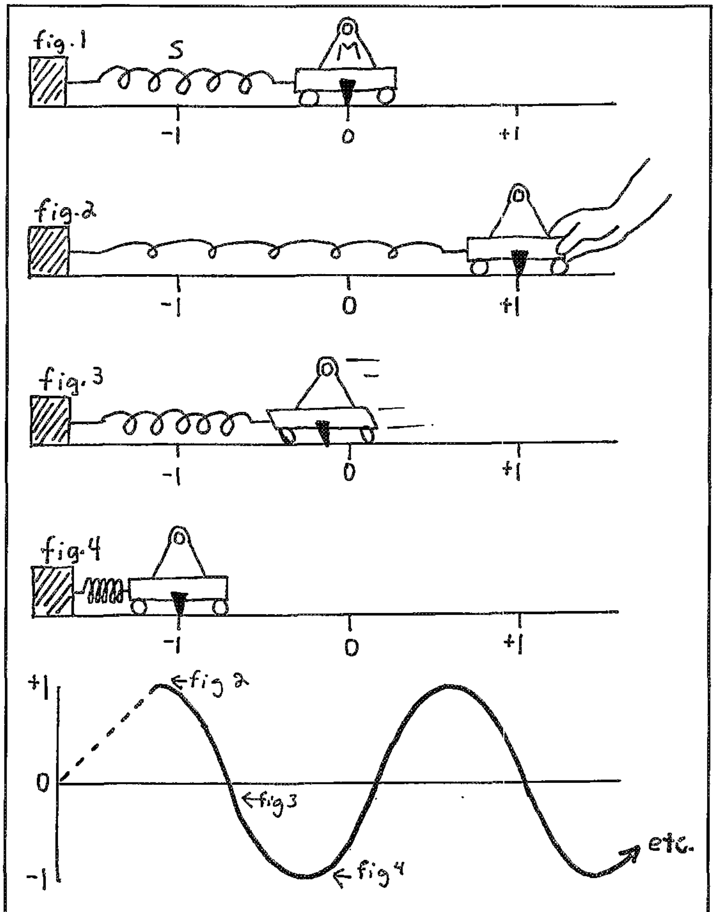


Illustration 1

Simple Harmonic Motion: ***Figure 1 shows cart at rest carrying its mass (M), spring (S), also at rest. In Figure 2, the cart is pulled to (+1), the system is out of equilibrium, and the spring is under tension. In Figure 3, the cart is released, and potential energy in the spring is transferred to the kinetic energy of the moving mass, the cart speeds past its point of equilibrium (O). In Figure 4, the cart has come to rest (-1), and the energy is now stored in the compressed spring. The motion of the cart is described in the graph.***

While our model conveniently separates the elastic properties from the properties of mass in order to clarify a vital principle, all physical bodies exhibit a combined form of both elastic and massive properties. The relationship between these two properties will determine the frequency of harmonic motion, whether the system is simple, as in the cart or, if the system is more complex, as in piano strings and soundboards. In many cases, and particularly in musical instruments, one or the other properties is manipulated or altered to enhance the harmonic properties. For example, when we increase the tension of piano wire we achieve a more musical tone. Without this tension the wire will act like an inharmonic bar rather than a musical string. The increased tension not only improves the tone, it also gives the string greater stiffness, the result of which is an increase in the frequency of vibration of the fundamental and all the partial tones. Another example of manipulating harmonic motion, this time changing the massive properties, is the copper winding on a bass string. The windings increase the mass without changing the string's stiffness, allowing the string to vibrate freely at higher tensions while keeping the frequency low.

Damping and Decay

As mentioned, an oscillating system without friction, and not connected to anything drawing energy from it, goes on forever. This, of course, only exists in theory. Vibrating systems in the real world, subjected to a loss of energy, will sooner or later return to rest. This process is known as decay. An oscillating system subject to decay does not change its frequency, only its amplitude is altered. Amplitude is the distance the body travels away from its state of equilibrium. The factors causing a vibrating body to decay are known as damping. There can be either internal damping, such as friction, or external damping, which happens when the energy passes from the first system into another, connected system. To illustrate this let us imagine that the cart in our first example has a small amount of friction in its wheels; as the cart moves it continually loses energy. The cart's speed keeps decreasing. The distance it travels get shorter and shorter. Soon it arrives back to its state of rest having used up the energy in the friction of the wheels. During the time the cart is moving back and forth the rhythm, or its frequency, remains the same. The same thing will happen if the cart, or any other part of the system, comes into contact with a body itself capable of harmonic motion. For example, if we tried the experiment of the cart underwater, the energy depleted stirring the water will damp the cart's motion. If the spring's support were not immovable but mounted on top of a soundboard or some other movable support, the cart's energy would slowly dissipate into this system. (See Illustration 2.)

Impedance

Another concept that is central to the understanding of downbearing is impedance. Impedance is the measure of an object's resistance to vibrations. An object with a high impedance will reflect vibrations, while one with a low impedance will readily absorb and convey vibrations. The same two factors of mass and stiffness that determine the frequency of harmonic motion also determine the amount of impedance an object contains, but instead of working against each other, as in harmonic motion, the object's mass and stiffness contribute equally in determining impedance. Massive and/or stiff objects have high impedance, reflecting vibrations, while objects that are lighter and less stiff have low impedance and will absorb vibrations.

Our concern here is the transfer of vibrations from one body to another. This is particularly relevant to the relationship between the strings and the soundboard. It is useful to remember that the strings are the driving system, and the soundboard is the receiving system. When the hammer

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The Effects of Downbearing on the Tone of the Piano ... Part 1

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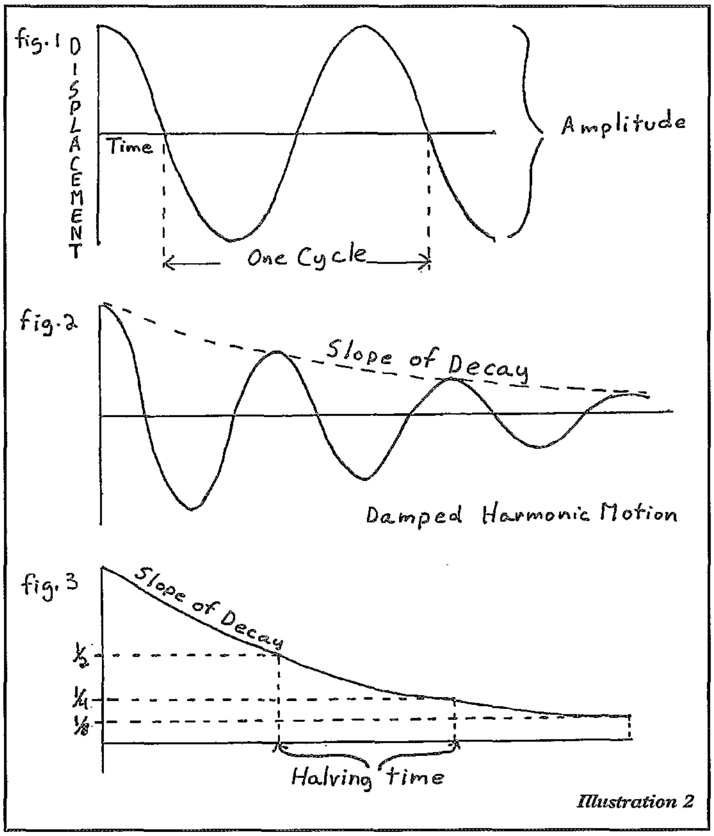

Illustration 2

Frequency, Amplitude, Damping and Decay: ***Figure 1 shows once cycle, frequency equals cycles per second; amplitude is expressed by the furthest displacements on the graph. In sound waves, this would be defined in decibels. Figure 2 shows a vibrations being damped; the frequency remains the same, but the amplitude decreases. Figure 3 shows the slope of decay defined by its halving time, the time it takes for the slope of decay to reach 1/2 its amplitude. The halving time remains the same throughout the process of decay.***

activates the strings, the rate at which the vibrations pass from the string into the soundboard will be determined by the amount of impedance of the strings as well as the impedance of the soundboard. To clarify this, it is useful to imagine the vibrations of a rubber band (low impedance) stretched between two brick walls (high impedance). Because the brick walls are very stiff and massive, the vibrations remain in the rubber band. If we provide the rubber band with lighter and less stiff terminations, such as slender wooden poles, the vibrations will quickly pass out of the rubber band and into the wooden poles. In the first example, the driving system (the rubber band) has much lower impedance than the receiving system (the brick walls). In the second example, the impedance of the driving system more closely matches that of the receiving system. When we choose different materials or change the structure of the model, we can use our knowledge of impedance to predict the rate at which vibrations will pass from one system into the another. The following equation, in simplified form, determines the amount of impedance in an object or structure:

Impedance = sq rt Mass X Stiffness

Impedance then determines the rate at which the vibrations of one system dissipate into another. Another related factor is the effect of impedance on the decay of the vibrations of the transmitter (rubber band) and the receiver (brick wall). To explain this further, let's use a simple model of a rubber band connected at one end to an immovable support and at the other end attached to an imaginary device equipped with a means of varying its impedance from that of the wooden pole to the brick wall. The rubber band is our transmitting system and the adjustable device our receiving system. A graph is connected to the device so that the vibrations received can be recorded. Once the rubber band is set vibrating, the rate at which the vibrations die down (damping) is determined by the impedance level set on the receiving device. If the impedance is set high, the vibrations in the rubber band damp slowly; if the impedance is set low, the vibrations will damp more rapidly. If we examine the amplitudes of the vibrations as they are being received by the receiving device, we will see that when the impedance is set high the vibrations have little amplitude but are well sustained. On the other hand, if the setting is low the amplitudes are higher and decay quickly. (See Illustration 3) What is really going on here is the application of the rule of energy conservation. In the case of high impedance, the energy expressed by vibrations in the rubber band slowly dissipates into the connected system. Since this energy is spread over a long period of time, the amplitudes, to be in balance, will be lower. When the impedance is set low the energy is rapidly absorbed into the device. This energy is compressed into a short time and, naturally, the amplitudes are high. As an analogy, consider a barrel of water with a spigot at the bottom. If the spigot is opened a small amount, the water pours out slowly and gently, it will take quite some time for the barrel to empty, and the water

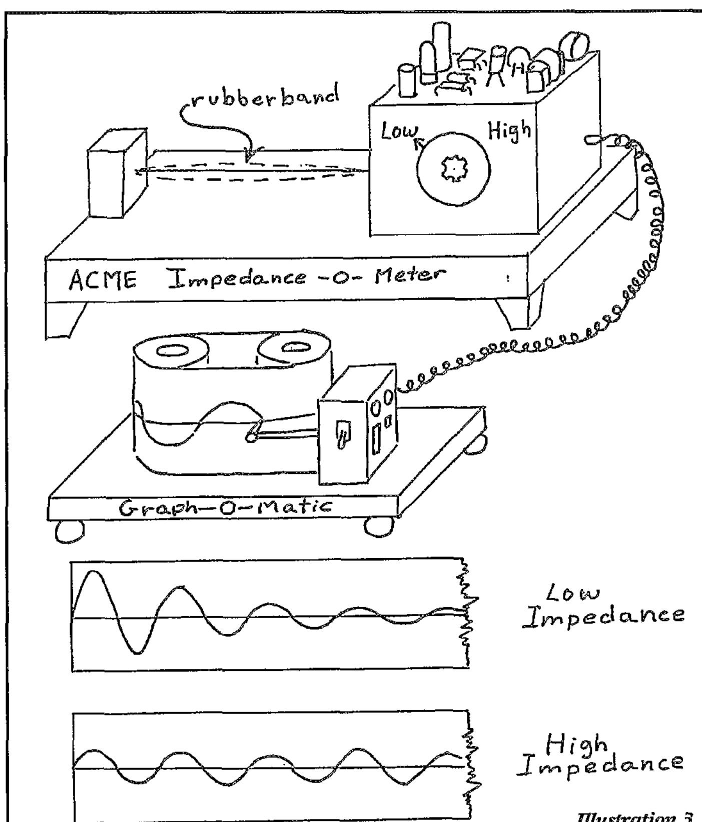

Illustration 3

Effects of Variable Impedance

does not splash as it hits the ground. If the spigot is opened all the way, however, the water rushes out rapidly and splashes violently when it hits the ground.

Sound Interference

It may seem remote to include a discussion of sound waves in an article about downbearing. While it is apparent to most of us that downbearing affects the behavior of the strings, it is not so apparent, but of equal importance, that downbearing has considerable consequence on the function of the soundboard and its efficiency in moving the air surrounding it — particularly how sound waves react with one another coming from the surface of the soundboard. Part two of this article will explore this in more detail, but, to make those explanations clear, the following review of sound wave interference will be useful.

When two sound waves of the same frequency collide, one of two things will happen; either they will tend to reinforce each other or they will tend to cancel out. In the first case, the result will be the amplification of the sound, while in the other, the sound will be diminished. When the sound waves reinforce one another, their crests and valleys overlap and are in phase. Two out of phase waves will have the crests of one wave coinciding with the valleys of the other; this condition is called "out-of-phase," and is also known as sound interference. Sound interference can occur in a number of ways. For example, two sound sources having the same frequency and spaced apart from each other by one half of their wave lengths will tend to cancel out. Another example would be two sound sources close to one another producing the same frequency but vibrating in opposite phase.

The Soundboard — Modes of Vibration

In addition to these brief remarks on acoustic principles, it will be useful to explain how the soundboard moves when it is vibrating. A simple experiment will show how the soundboard behaves. Salt, or some other fine particles, are evenly spread over the surface of the soundboard (in my experiment the soundboard is in the piano but the strings and plate are removed). A large speaker connected to an amplifier and a function generator is placed under the piano. The function generator produces a simple sine wave signal adjustable in frequency. With the generator set to a low frequency (under 50 Hz) and the amplifier set to medium high, the speaker produces a pure low tone. The soundboard vibrates sympathetically to the frequency produced by the speaker, making the salt dance on the surface. At some frequencies the salt will dance more vigorously. If the tone is left at these frequencies for half a minute or so, the salt will move out of the areas of the soundboard which are vibrating into areas that are not vibrating. In this way, the salt will form patterns that outline the areas of the soundboard that are vibrating with the most energy (See Illustration 4). As one continues the experiment, slowly increasing the frequency, a number of differing patterns will be found. Each pattern will be associated with a specific frequency. The patterns at the lower frequencies form large, simple shapes. As the frequency is increased, the salt outlines smaller shapes dividing the soundboard into many vibrating disks. For example, at 52 Hz the pattern defined by the salt may show that the soundboard is vibrating as a large, single sound source while the pattern at 88 Hz shows that the soundboard is vibrating as two sound sources, one moving up as the other moves down. This process continues further, finding more patterns as the frequency is increased. Eventually, seven or eight definable patterns will be found. Each new pattern divides the soundboard's surface into smaller and more numerous areas.

The frequencies found in this experiment are known as response frequencies. This simply means that this particular soundboard is more sensitive to these frequencies. If we tap on the soundboard, the thud we hear will be made up of the response frequencies which, for the most part, don't directly contribute to the sound we hear. In a well-designed piano in good condition, this soundboard noise only contributes to the other mechanical noises we hear in the attack of each note. The patterns we have found are the way the soundboard behaves when it is vibrating. They are known as modes of vibration and are usually numbered 1,2,3, etc., from the simplest, low-frequency mode on up to the complex, high-frequency modes. These modes are analogous to the way a string vibrates in its modes: vibrating as a whole, in half, in thirds, etc., each mode having a frequency we call the fundamental and upper partials. The soundboard's modes and the string's response frequencies are almost the same idea except that the soundboard is more complex and functions as a driven system, receiving vibrations from the strings.

The soundboard can only vibrate in the form of its natural modes. Fortunately, it is unlimited in the number of different frequencies it can respond to at the same time. Whether the soundboard is stimulated by the influence of the speaker, as in the experiment above, or by the vibrations of the strings, it is forced to vibrate at the same frequency as the stimulus. As we have seen, when the frequency of the input equals any of the natural modes of the soundboard, the soundboard will vibrate purely in that mode. What is not clear from the experiment is that when the frequency of the input lies between the response frequencies of the soundboard's natural modes, all of the soundboard's modes will be activated to some degree. The soundboard modes with response frequencies closest to the input frequency are activated the most, while those that are further away will be less activated. This means that when the lower strings in the bass are played, their fundamental and first few partial tones will primarily activate the lower series of soundboard modes. The higher strings and the upper partials of lower strings will activate the higher modes. The fact that the soundboard vibrates in different modes when it is stimulated by either low tones or high tones will be important later, when discussing the effects of downbearing on the efficiency of the soundboard.

It is important to note that the modes and their assigned frequencies will vary a great deal among different makes and models of pianos, and, to some degree, from piano to piano. In fact, controlling the modes in the manufacturing process with any degree of accuracy is difficult because of the numerous and diverse factors that can effect them. One of these factors that we will discuss later, and in more detail, is downbearing. The above experiment was

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performed on a soundboard without strings. It is predictable and certain that when the same soundboard has strings and downbearing, the frequency of all the modes will shift higher, leaving the shapes of the modes, for the most part, undisturbed.

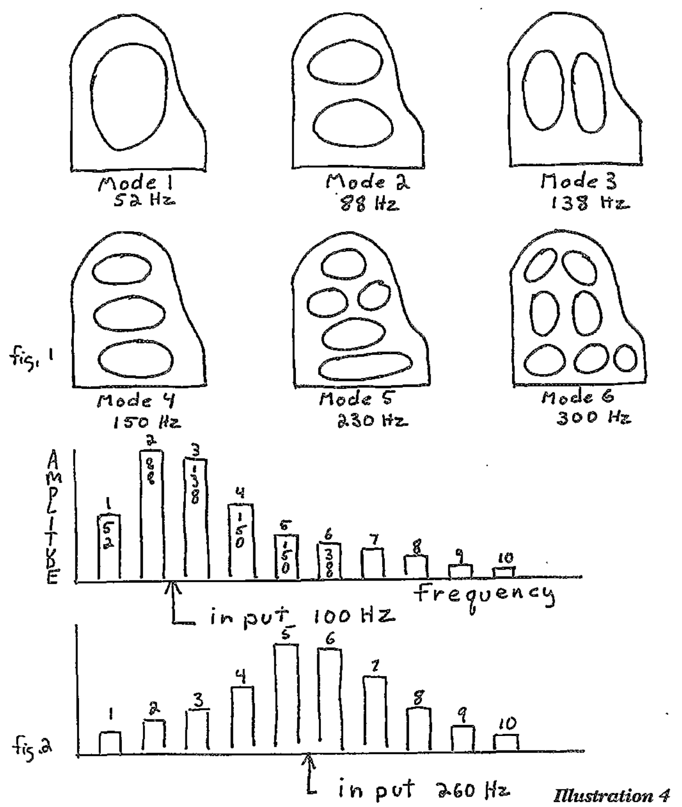

Illustration 4

Soundboard Modes of Vibration: ***Figure 1 shows the first six modes of a typical piano soundboard with each corresponding response frequency. Figure 2 shows two graphs representing how the soundboard will vibrate at the same time. The first graph shows a low-frequency input of 100 Hz.***

Tuning Hammer Geometry

By Jim Ellis, RPT

Introduction

There is a popular belief among some piano technicians that a tuning hammer equipped with an extra short head, bored at a 15-degree angle, is better than the standard (medium) head hammer bored at a 5-degree angle (cover, October 1994 *Journal*). The assumption is that the extra-short head reduces the flag-poling of the tuning pin, while the 15-degree incline of the handle keeps it away from interfering parts of the piano plate. "Flag-Poling" is piano technician's jargon for the back-and-forth, side-to-side flexure of a tuning pin that occurs as a result of the forces that are applied to turn it. The assumed advantage of a short-head, high-angle tuning hammer over one with a standard (medium-length) head bored at a 5-degree angle has been taught at seminars, conferences, and at least once at a PTG annual convention. Its popularity prevails in spite of the fact its assumed advantage is based upon a false conception of force vector physics.

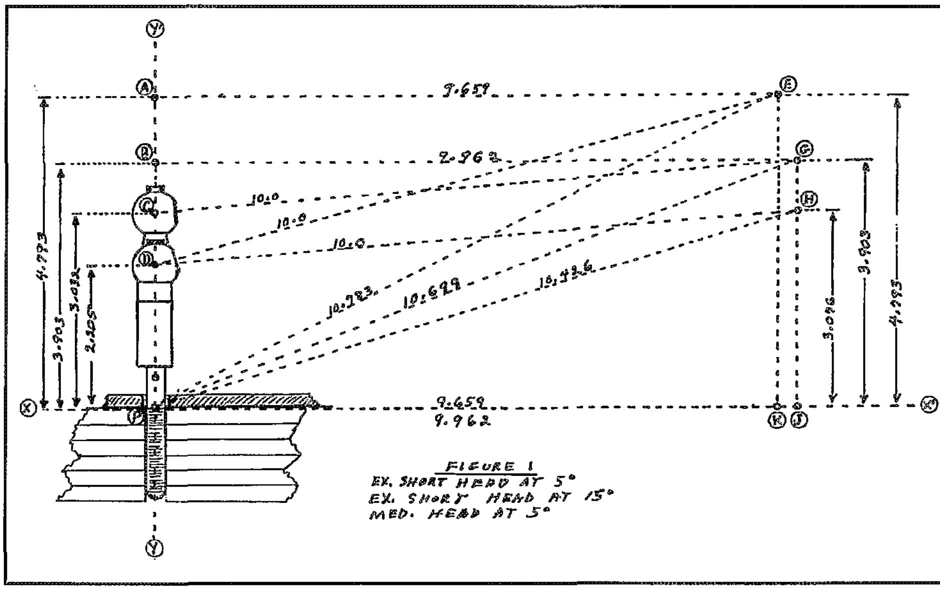

FIGURE 1
EX. SHORT HEAD AT 5°
EX. SHORT HEAD AT 15°
MED. HEAD AT 5°

Vector Analysis

If we assume that the tuning pin is at the optimum height, then the fallacy of the short-head, high-angle theory seems to be a belief that the length of the head alone determines the flag-poling of the tuning pin; it does not. The movements of force, both torsion and bending, are determined by the intensity, direction, and location of the applied force relative to the tuning pin. The tuning hammer head is only one of the "links" in the "chain" that couples the force to the pin. It alone cannot determine the bending forces delivered to the pin.

Figure 1 is a force vector diagram showing: 1) an extra-short head bored at a 5-degree angle, 2) an extra-short head bored at 15 degrees, and, 3) a medium head bored at 5 degrees. A one-inch-long #2 tip is used in each case in this analysis. The tuning pin is a 2/0, and the effective length of the handle is 10 inches. The piano in this analysis does not use tuning pin bushings, but the same principles would apply if it did. The tuning pin is at its optimum height.

Let's assume that we are dealing with a grand piano. The exact dimensions will vary a little bit depending upon the make and model of the piano, the manufacturer of the tuning pins, and the maker of the tuning hammer parts, but the dimensions shown will serve as approximate averages. In all cases, I am assuming that the force applied to the handle of the tuning hammer is in a direction that will turn the tuning pin rather than spring it back and forth. I'll sometimes refer to that as a "tangential" force, meaning that its direction is parallel to the plane of the pinblock and at a right angle to a line parallel to the radius of the tuning pin. In other words, imagine an invisible disc parallel to the baseline and located anywhere along the vertical axis Y-Y'. The force I am talking about would be applied at a tangent to that disc at whatever height we put the disc along axis Y-Y'. Torsion without bending will be applied to the tuning pin if the force is tangential and in the plane of the pinblock. That is obviously impossible because the pinblock and plate are in the way. For practical purposes, the handle of the tuning hammer has to clear all obstructions.

Referring to Figure 1 again: Line segment D-P represents an extra-short head, tip, and a tuning pin down to the surface of the pinblock. Line D-E represents a handle with an effective length of 10 inches. By effective length, I mean the distance from the vertical axis to a point on the handle that represents the center of where the force is applied. The head is bored at 15 degrees, which puts the handle at a 15-degree incline to the baseline. Lines P-K and A-E are opposite sides of the parallelogram that resolves the force vectors. Baseline segment P-K and line A-E at the top represent pure torsion. If a tangential force is applied at point K, it will produce pure torsion at the tuning pin. The same tangential force applied at point E will produce the same amount of torsion, but it will also produce some bending force at the tuning pin. The amount of the bending moment of force will be proportional to the line E-K. A force applied at point A will produce the same bending moment that it would if it were applied at point E, but it obviously will produce no torque.

Lines P-D-E define—detail the force vectors of — a tuning hammer with an extra-short head bored at 15 degrees and a handle with an effective length of 10 inches. A tuning hammer defined by lines P-A-E would produce exactly the same ratio of torsion to bending as one defined by lines P-D-E. The sum of the vectors for this example is shown by the diagonal line P-E, and it does not change, regardless of the head configuration, as long as the same tangential force is applied at point E.

Lines P-D-H define a tuning hammer that has an extra-short head bored at a 5-degree angle instead of 15 degrees. The effective handle length is exactly the same, but the torsion component represented by line segment P-J is slightly greater (than P-K). The bending moment of force, however (line J-J) is much less than the one (E-K) for the 15-degree head. This arrangement takes full advan-

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Tuning Hammer Geometry

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tage of the extra-short head, but there are many places where it can't be used because the handle will not clear some obstruction. There is a noticeable advantage in using it where it will work. The "feel" of what the tuning pin is doing is more precise because there is less flexure of the pin. For small verticals and a few studio uprights, I use a very light tuning hammer of my own construction that has an extra-short head and 5-degree angle. It's somewhat similar to Charlie Huether's "Wonder Wand," except for the handle and angle of the head.

Lines P-C-G define what was perhaps the "standard" tuning hammer for many years. There is a good reason for that. The length of the "medium" head keeps the shank up clear of almost all plate bars and struts, but the low angle of the head's bore keeps the end of the handle, the hand, and the applied force in a relatively low plane, just high enough to clear most obstructions. In my opinion it is clearly the best compromise for big grands. **Figure 2** shows an outline of such a tuning hammer and compares it to one with an extra-short head bored at 15 degrees.

It is very easy to understand the different force vectors involved with tuning hammers if we remember that the horizontal axis X-X' represents torsion, and the vertical axis Y-Y' represents bending force. The torsion component is proportional to the amount of force multiplied by the distance from the axis of the pin as measured along a line perpendicular to the vertical axis. The bending force is proportional to the height of the force above the baseline, whether it is the pinblock or a tuning pin bushing in the plate, multiplied by the amount of force. The precise configuration of the handle, the head, and the tip has nothing to do with it. It is solely a matter of force, the direction of the force, and where the force is applied relative to the tuning pin.

Now that I have made the statements that I have, someone is surely going to say, "Yes, but the tuning hammer with the shortest head is going to be the most rigid." That's very true, but the problem is not the tuning hammer. The tuning hammer is many times more rigid than the tuning pin. The problem is the tuning pin, not the hammer! Anything we can do to reduce the unwanted springing of the tuning pin while we are trying to turn it will help. The longer the handle, the greater the ratio of torsion to bending, but there is a practical limit. If the handle is too long, then one loses the "feel" of the pin.

Table 1 lists the nominal dimensions of the three tuning hammer configurations that I have described. **Table 2** shows the equations and calculated values for the various force vectors. If the handle were always perpendicular to the axis of the head, the vectors would be very simple to calculate. But the handle is not perpendicular. It's at an angle. Therefore, the torsion component is proportional to the cosine of the angle, and the bending component is proportional to the sine of the same angle plus the height of the head, where the centerline of the handle (the bore of the head) intersects the axis of the head. The one place where the extra-short head and high angle is needed is where there is some obstruction that the tuning hammer must go back under, and the medium head just won't go.

Table 3 shows the total strain on the tuning pin as a function of tuning pin torque for an extra-short and a medium head bored at a 5-degree angle, and for an extra-short head bored at 15 degrees. The total strain in each case is represented by one of the diagonal lines (P-E, P-G, or P-H, as the case may be, in Figure 1). The short head with the 15-degree bore is the worst, not the best, of the three as far as the flag-poling of the tuning pin is concerned.

Table 4 shows the results of some tuning-pin failure tests that I did. As expected, failure was always at the eye. It didn't seem to make much difference whether the strain was torque or bending. Failure occurred at about the same number of inch pounds either way, although they did produce different kinds of breaks. The object of this test was to see how much more of a safety margin there would be in using a tuning hammer with a very low force angle as opposed to one with a high force angle. The torque of a tuning pin in the low bass of a concert grand can easily run as high as 225 to 250 inch-pounds in the forward direction because of the high tension. Size 2/0 tuning pins begin to fail around 280 inch-pounds, either bending or torque, or a combination of both. If the forward torque of that big grand is all the way up to 250 inch-pounds, and you are using a tuning hammer with a low-angle handle that's at least 20 inches long, you are probably okay. But if the forward torque is that high and you are using a 15-degree head, you are apt to be in trouble. The difference isn't very much, but on an extremely tight tuning pin it might be the difference between a completed tuning and a broken pin. I have come across two rebuilt pianos that came in from out of state with tuning pins so tight that they were ready to yield before they turned in the block.

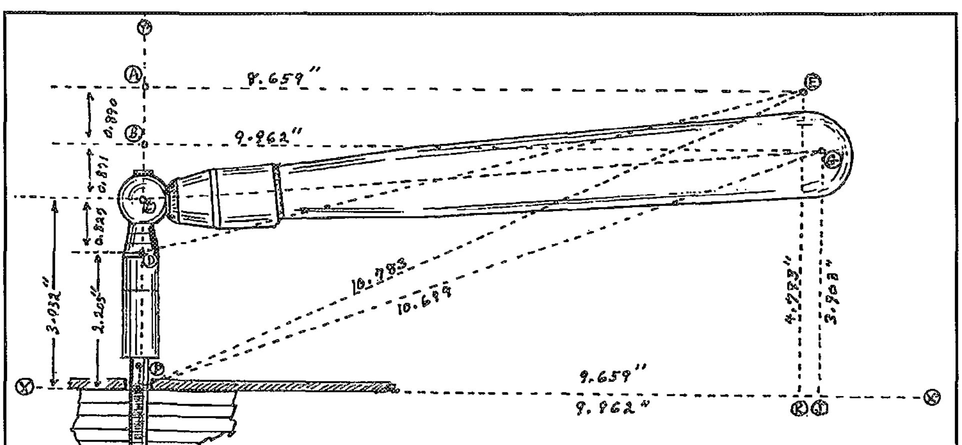


FIGURE 2
MEDIUM HEAD AT 5°
EXT. SHORT HEAD AT 15°

Summary and Conclusion

There is no advantage in using a very short head on a tuning hammer if the incline of the handle is high. The high angle defeats the purpose of the short head. For all-around purposes, the standard tuning hammer with medium-length head bored at a 5-degree angle is superior to one with an extra-short head bored at a 15-degree angle. The true advantage of a very short head can only be realized if the angle of the handle is kept low, and at a reasonable length, not less than 10 inches.

TABLE 1

NOMINAL DIMENSIONS OF TUNING HAMMER HEADS AND TIPS. REFERENCE IS LINE INTERSECTION	MILLI-METERS	INCHES
Ext.short head to end of #2 tip (1" long)	39	1.535
#2 tip to eye of 2/0 tuning pin	3	0.118
Eye of pin to pinblock (average)	14	0.550
Medium head intersection of lines to tip end	60	2.362
(CF) med. head intersect to pinblock	77	3.0315
(DP) Ex short head intersect to pinblock	56	2.205
handle length (l) all three cases CG, DH, DE	254	10.00

TABLE 2

Line PJ, 5° (base) = 254 cosine 5°	253.0335	9.962
Line PK (base) (15°) = 254 cosine 15°	245.345	9.659
Line HJ = (254 sine 5°) + line DP	78.138	3.076
Line GJ = (254 sine 5°) + line CP	99.138	3.903
Line EK = (254 sine 15°) + DP	121.740	4.793
Line PH = $\sqrt{PJ^2 + HJ^2}$	264.824	10.426
Line PG = $\sqrt{PJ^2 + GJ^2}$	271.761	10.699
Line PE = $\sqrt{PK^2 + EK^2}$	273.888	10.783

TABLE 3

TORQUE (in.lb.)	TOTAL STRAIN WITH 10-INCH HANDLE 5° Ex SHORT	5° MED	15° EX SHORT
100	104.7	107.4	111.6
200	209.4	214.8	223.2
225	235.6	241.6	251.1
230	240.8	247.0	256.7
240	251.3	257.8	267.8
250	261.8	268.5	279.0

TABLE 4 FAILURE STRAIN FOR STEEL TUNING PINS (in. lb.)

SIZE	YIELDS	BREAKS
2/0	280	295
3/0	345	360
4/0	360	375
5/0	390	410

Tuning Out Noises ... Part 1

By Ernie Juhn, RPT
Long Island Nassau Chapter

A study of noises that have plagued tuner-technicians since the beginning of (piano) time. I will try to supply some proven solutions. They work most of the time — not always.

Introduction

We will have to start by recognizing a few facts. What is music to some may be noise to others. I believe that if Bach had heard some of today's music he would have called it noise. So let's not spend too much time on theories and move right on to the practical part of the subject. Let me just make one more stop, and elaborate a little on something that has to do with "noises." There can be quite a difference between a very "mellow" sounding piano and one with a rather brilliant tone. No doubt some musicians prefer one over the other. It would not surprise me at all to hear a person who loves a very mellow tone in a piano, call a very brilliant instrument "noisy." I think this is pretty clear to most of us. With that in mind, I believe that it is a mistake to make pianos sound the way *we* like them to sound. We are technicians — and we get paid to make instruments sound ***the way the customer likes them to sound!***

The first step in diagnosing a noise has to be the ability to interpret the customer's terminology. Bear in mind that pianists are not piano technicians. In fact, pianists, as a rule, know less about their instrument than musicians who maintain their own instrument, like string and woodwind players, etc. It is therefore not surprising that often the description of a noise does not quite describe the complaint in the best way. Add to it the possibility of the complaint being about a noise that only happens irregularly, and we can see that diagnosing and correcting noises in pianos is not an easy task.

The Phantom Vibration

Let us start with the most common situation. An objectionable "vibration" heard sometimes, but — you guessed it — it doesn't do it today. The first step would be to do everything that could possibly be done to eliminate the cause of the noise. Very often the customer provides clues to the mystery. For instance, the statement that the noise stops when the music desk is removed may help in finding the problem. Another good remark would be that when the front part of the top of the grand lid is opened or closed the noise goes away. That would be a fairly good indication of a rattling hinge pin.

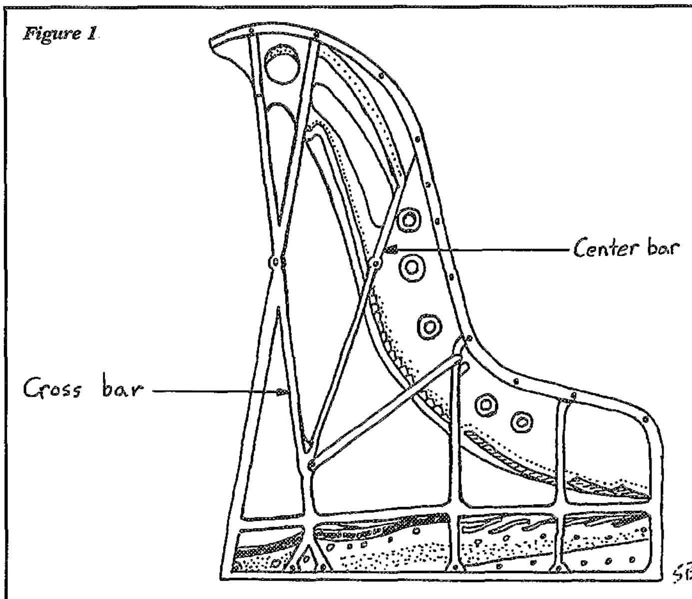
In a long hinge, the pin is a long piece of wire or, very often, two lengths of wire. These long hinge pins are notorious for "vibrations." Here is a simple way to correct it: Use an awl, and tap the hinge pin wire from one side of the hinge. When a small portion of it comes out at the opposite end of the hinge, use vise grips to pull out the pin. When out, lubricate the wire with either VJ lube, Lubriplate or similar lubricant (*not* oil). As a bonus, it is easier to reinsert the wire into the hinge. If there are two pieces of wire, repeat the maneuver for the second pin from the opposite end of the hinge. The "vibration" should be gone.

Hardware is a frequent cause for noises. Grand lid locating hardware, certain lyre braces and adjustable pedal rods have been known to vibrate. Piano locks are another source of rattles and noises. I found that VJ lube or Lubriplate are effective cures when applied to all moving parts inside the lock. These cures are based on the fact that lubricants "of substance" do away with the so-called "dry vibrations."

Unwanted Resonances

At this point, I would like to switch to a different kind of noise, namely, the kind that could be called musical tones, except that they are excessive, loud or simply too numerous. Let us assume that a pianist complains that he/she hears a certain note "all over the place," no matter what is being played. This situation will make me look for two problems. The first, and by far the more frequent one, would be the duplex section. Let me elaborate. The duplex section of the scale was created for the purpose of making parts of the non-speaking length of strings vibrate sympathetically when a hammer strikes a string. Due to fixed aliquot bridges and mostly non-tunable duplex sections, there is a chance of more duplex strings ringing at one frequency than at another. Consequently, we may hear certain notes more (or louder) than others. Obviously muting the part or section would work, but that is not always the best solution. For instance, if a customer just purchased this expensive instrument and was told by the sales person about the wonderful duplex feature, it may not be wise to mute it out. There is, however, a simple way to stop these offending "ringers." A small amount of (again) VJ lube or similar lubricant applied to the duplex part of the string will stop it from ringing. Bonus: It is invisible, reversible and harmless.

Figure 1



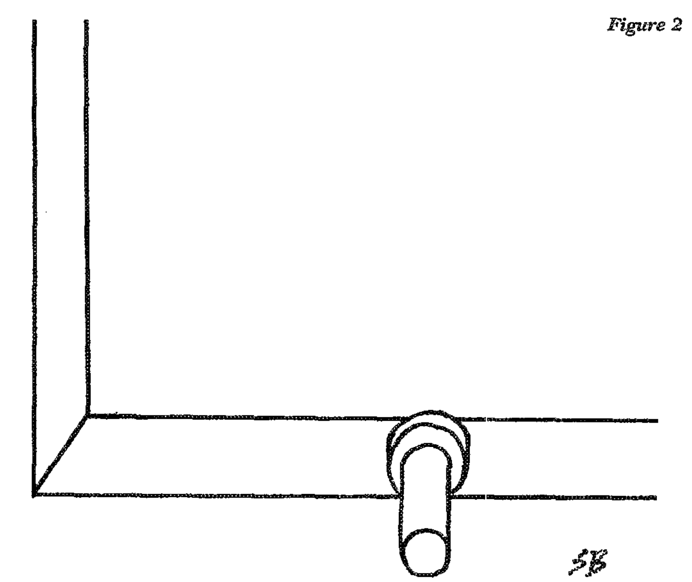
The second possibility would be the "cross bar" and/or the "center bar" of the plate (See Figure 1).

These long bars of the piano plate can ring quite nicely. There is a pretty good chance that in a well-designed scale these parts of the plate will not bother anyone. It is possible, however, for either the "cross bar" or the "center bar" to resonate at a frequency that will bother someone with good ears (or a microphone)! Unfortunately, I do not have a good cure for this problem that can be used in a home. (In a recording studio, where appearance is of minor consequence, a tightly wrapped bungee cord works wonders.) ***However,*** before I give up, I would check the pitch that the piano is tuned to. If the instrument is off a lot, there is a good chance that tuning the piano to the pitch it was designed for may get rid of the "plate ring." It should be noted that I am not only speaking of pianos below standard pitch but also of instruments which have been designed to be tuned to 440 but have been pulled up to 442, 444, etc. (I often wondered if Beethoven's 7th Symphony would sound "brighter" in A#.)

Bottom-Dwellers

An entirely different area is the bottom of upright pianos. The noises coming from the bottom area of uprights are so numerous that one would hardly know where to begin. The most common but often misdiagnosed noises originate at the bottom front panel, pedal rail and, of course, the bottom board. The fact that we hear annoying, often "creaky" kinds of noises when the pedals are used does not necessarily indicate that the problem comes directly from the pedals. As in all troubleshooting jobs, we have to have an analytic mind in order to find the cause of the problem. The first step in the above-mentioned case would be to remove the bottom front panel. If the noise disappears, the creaky noise is clearly caused by the bottom front panel rubbing against the pedal rail. The cure, of course, is simple. If we are dealing with the kind that uses locating dowels, just cut punchings out of a thin piece of felt and place them over the dowels (See Figure 2).

Figure 2



That will raise the bottom front panel slightly and prevent noise caused by friction between it and the pedal rail. If the bottom front panel does not use dowels but fits into a groove of the pedal rail, lubricating with a lubricant like Lubriplate, VJ lube or even paraffin will work well. If that was not the problem, continue by making sure that the bottom board is tight. Unfortunately, the proper way to do this involves a piano tilter. (Yes, an offset screwdriver often works.) Should that not be the cause of the noise either, the next suspect would be the pedal rail. Most of them are either screwed into the sides with angled screws, small metal angle brackets or both. Tighten these screws. These steps should do away with almost all noises coming from that area.

Squeaky Knuckles

On grands we often hear (and also feel) an annoying rubbing noise when keys are depressed slowly. Most technicians will suspect the knuckles right away. Most likely they will prove to be the cause of the problem. To make sure that the noise really comes from the knuckles, just activate the assembly with your fingers at the capstan area. If the noise is still present, you are right. It comes from the knuckle area. First, a word or two about how ***not*** to solve it. ***Do not*** load the knuckles with graphite grease. If a lot of graphite grease is found, please use a good cleaner, like "Afta," or even kerosene, and clean the knuckles. Benzine works well, too. Now that they are clean, leave the knuckles clean and very sparingly lubricate the top of the repetition lever (and top of jack). The original lubricant is generally graphite or Emralon. If you can duplicate that, by all means do it. I must, however, point out that no heavy coat of any of these lubricants is permissible! The graphite was burnished on, so that is what you will have to do! If, on the other hand, you are looking for a faster and (almost) as effective method, a Teflon spray works well. ***Warning!*** It must be a "dry" Teflon spray, nothing wet, and definitely nothing with silicone.

But what if the noise is still present? The next area we should look at is the keys. First suspect: capstans. Again, unusual massive buildup of graphite grease or other "smeary" stuff should be cleaned off. Capstans should be polished with a metal polish like "Brasso" or "Noxon." A very light coat of dry Teflon spray is permissible. Second suspect: the top of the balance rail pins. This area quite often produces noises that sound very similar to the typical knuckle noise. It is produced by the top of the balance rail pin rubbing against one or both sides of the key button bushing(s). The cure is either a thin coat of dry Teflon spray or VJ lube applied sparingly.

I have seen (or heard) noisy front rail pins, but they did not sound like the above-described kind of noise.

Ringing Notes

The mystery of the ringing note. You strike a note in the center of the piano, release the key, and it keeps on ringing. First test: use your finger and stop the ringing — it does not stop. Next, use masking tape and stop all duplex strings from ringing — it still rings. Check the plate and all other sympathetic ringers of the piano — no success. What now? We are getting close.

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Tuning Out Noises . . . Part 1

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Use your hand and systematically cover (mute) one area at a time, starting at the bass area and continue into the treble, while striking the "mystery" note. There is a good chance that at one point you will discover an area that, when muted, will stop the ringing. Now, it is time to narrow the search down to one note. When you find the one note that rings sympathetically when excited by the "original" offender, you have found the trouble. Now comes the solution. First determine whether or not the newly found offender has a damper, or if it is located in the open (treble) section. In the very unlikely case of it being in the "open" section, I have to tell you that the problem probably will not be solved. If, however, it has a damper, the first step would be to go through a standard leaking-damper troubleshooting procedure ("Installing and Regulating Grand Dampers," December 1975 issue of *PTJ*).

There is a good possibility that fixing this newly found offender will solve the problem. If, however, it turns out to be in the bass area, there is one more possibility. Due to the "compromise" straight damper line, when the so called "ideal spot" for the damper location is in reality somewhere else, the damper may mute almost perfectly (and quite satisfactorily when compared to the rest of the dampers), but it may respond to being excited by another note. We have already established that when muting the string with our hand or finger, the problem disappears, and yet the string(s) vibrate sympathetically when excited by another string. The solution is simple. Cut a piece of damper felt 1/4 to 3/8 inch long similar to the one used on the offending damper. Insert this piece of felt in the area between the two (or three) pieces of felt. Move them around with tweezers and empirically move it forward and back until — and this will surprise you — suddenly the sympathetic ring (when the original trouble note is struck) will stop. That is the spot where you permanently glue the new piece of felt to the damper head. Mystery solved.

The Designer's Notebook — Front Duplex Stringing Scales

By Delwin D. Fandrich, RPT
Contributing Editor

Introduction

This article, like my article in the June issue, was prompted by the February, 1995 PTJ *Roundtable Discussion on V-bars and zinging strings. This month we'll move from the vertical V-bar/pressure bar arrangement to the grand piano's Capo d'Astro bar/ counter-bearing bar system. There are more similarities between the two systems than there are differences. But those differences are significant.*

William Braid White & Samuel Wolfenden

There is very little written material available to the student of piano design. Most of what has been written dates from the early part of this century and the last part of the 19th century, not exactly state-of-the-art research material! Since its invention, most of the advances made in the art/science of piano design were made by piano builders/technicians, not engineers and scientists. Unfortunately, most of those builders/technicians were not interested in or, for obvious reasons, were unwilling to put their knowledge down in print.

For example, Albert B. Vant, in his book, "Piano Scale Making" (1927), wrote: "Piano Scale Making is the Design of the interior of a Piano, it takes in every part of the Piano, Sounding Board, Strings, Keys, Touch, and even the outlines of the Case, in fact everything pertaining to Tone, Touch, and even the outlines of the Case, it is a work that very few of the Factory Workmen ever get to see.

"The Drawing of a Scale is generally made in a Locked Room, by one of the very few Scale Makers, and a great secrecy is made out of their work.

"Bridge Patterns and Dimensions in general are furnished by the Scale Maker from his Master Drawing, and the employees of the different Branches or Operations are supplied with the necessary Patterns and Templates that pertain to their Branch of the Business only."

(*The punctuation and use of capitalization are those of the author, Mr. Vant.*)

In the English language, then, we are left with just a few key books. Among them are: "The Theory and Practice of Pianoforte Building," by William Braid White. (Second Edition, 1909); "A Treatise on the Art of Pianoforte Construction," by Samuel Wolfenden. (First Edition, 1916. Supplement to the First Edition, 1927); "Proceedings of the Piano Technicians Conference," Chicago 1916, 1917, 1918 and New York 1919. A more recent, and generally more accurate and useful work is: "Fundamentals of Musical Acoustics," by Arthur H. Benade. Oxford University Press (1976).

Much good information about piano design and construction — at least from an historical perspective — is contained in these volumes, but, with the exception of Benade's "Fundamentals of Musical Acoustics," none of them contains what can be called modern scientific information about piano design. To use any of these early volumes as our "bible" of piano design would be a mistake. Too much of our understanding of piano design suffers from a rigid adherence to the principles laid out by these authors. The information contained in them may well have been state-of-the-art when written, but that was (in most cases) about three-quarters of a century ago!

Having said this, I'd like to make a couple of comments about Steve Brady's introduction to the Roundtable Discussion in the February, 1995 *PTJ*, which pretty much sums up my evaluation of two of the books mentioned above. He quoted some of Samuel Wolfenden's and William Braid White's comments about the Capo d' Astro bar vs. the agraffe string.

Termination Mechanism

First, Wolfenden was discussing only the problem of locating and physically terminating the speaking length of the string. He didn't get into any specific acoustical advantages or disadvantages of either system, nor did he speak of any tests done to evaluate either system. A couple of paragraphs later in the same chapter, though, he went on to say, "... still, in view of the satisfactory results attained by the use of the cast-in bearing bar (i.e., the Capo d'Astro bar), there is no present inducement to design grand pianos with stud bearings (agraffes) in the upper part."

Second, I'm not sure at all on what theories or evidence White based his comments about the alleged acoustical disadvantages of the Capo d'Astro bar. Again, no tests or analytical analyses are cited. This comment now stands against the documented results of work done by several respected piano researchers over the years that has consistently shown that the mass of the Capo d' Astro bar gives the system mechanical efficiency advantages not available in agraffe systems.

Finally, let's keep in mind that, while William Braid White studied, theorized and wrote about pianos, Samuel Wolfenden actually built them.

(Note: *I should warn you in advance that some of what I have to say in this, as well as in subsequent articles, may well contradict some of what you may have read and heard in the past about how pianos function. Indeed, it contradicts much of what I thought I knew about pianos 10 or 20 years ago. About this I can only say that sacred cows make great hamburger! Hear me out and consider some alternative concepts. None of what I'll be presenting in this column is intended to be the final word on this or any other subject; I'll appreciate hearing about any alternate views and experiences you may have.)*

Grand V-bars vs. Vertical V-bars

In the June article, I discussed the basics of vertical piano V-bars and pressure bars. So, what do upright V-bars have to do with grand piano Capo d'Astro bars and V-bars? Well, consider: When was the last time you had a problem with "zinging," or buzzing, strings in a vertical piano? With the exception of those few verticals still using tuned front duplex stringing

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The Designer's Notebook — Front Duplex Stringing Scales

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scales, it almost never happens. Also, you will find some grand piano designs that are almost completely free of the problem while others are so bad as to remain quite annoying no matter what you do to try to fix them. Over the years, I've conducted a variety of different experiments attempting to shed some light on this whole subject, and, while I'm certain I don't have all the answers, I do have some ideas that seem to make sense — a few of which I'll present here.

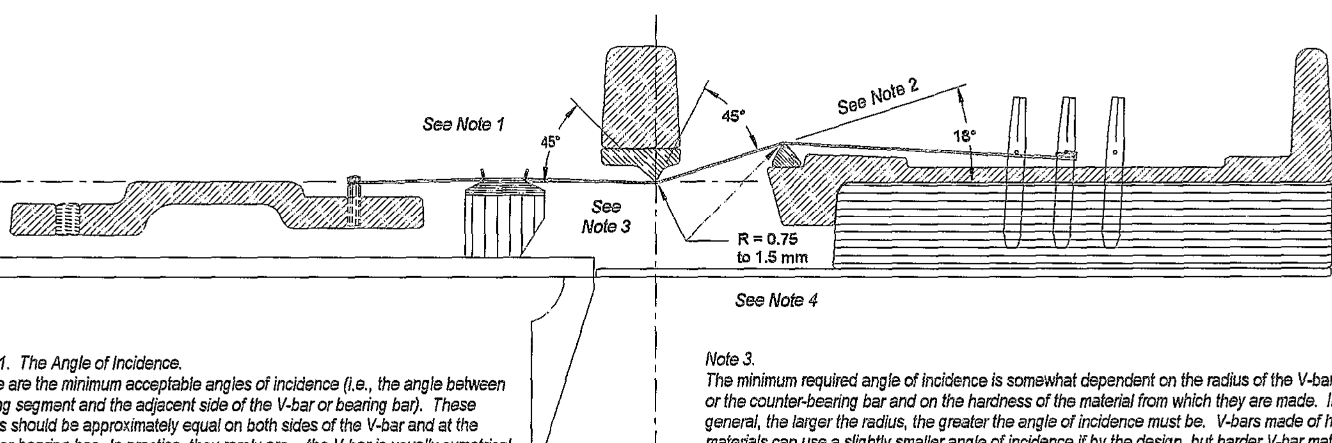
(Note: *Since there doesn't seem to be any convention regarding the nomenclature referring to the various segments of a piano string, for the purposes of these articles I have been using the term "front duplex," or simply "duplex," to refer to that segment of the string between the V-bar and the counter-bearing bar, or pressure bar, whether it is "tuned" or not. In general, if I am referring to a tuned duplex string segment, I'll say "tuned duplex string segment," or simply, "tuned duplex." There is also a "back duplex," of course, but not in this article.)*

The string deflection angles have been within acceptable limits on most of the grand piano plate designs I have studied; still, nearly all grands are plagued more with zingers than are verticals. A further observation: in general, those with the worst string noise problems are those with "tuned" duplex scaling in the Capo d'Astro bar sections.

Whether or not the duplex string segments are tuned, they are nearly always longer than those found on vertical pianos. The duplex string segment on most vertical pianos is around 15 to 25 mm long. To "tune" this segment requires a somewhat greater length, normally around 25 to 55 mm. Even if they are not tuned, duplex string segments are generally much longer than 25 mm in grand pianos. Lacking any explanations to the contrary, it appears that this additional length is the catalyst that allows most of the string noise problems we encounter in these designs to develop, and "tuning" these segments simply makes an inherent problem worse.

Front Duplex Strings

In theory, tuned front duplex scaling is intended to be a mechanism by which the scale designer is able to get a little bit of "free" power in the first and second treble sections of the piano. This is accomplished by making the duplex string segment long enough so the string can "pivot" across the V-bar. This duplex string segment is then supposed to be "tuned" to some harmonic (or string partial) of the fundamental frequency of the unison in question by carefully positioning a counter-bearing bar some precise distance away from the V-bar. This distance is calculated as if it were actually a speaking string, which in a sense it is. The vertical position of the counter-bearing bar in relationship to the bottom of the V-bar also establishes



Note 1. The Angle of Incidence.
These are the minimum acceptable angles of incidence (i.e., the angle between a string segment and the adjacent side of the V-bar or bearing bar). These angles should be approximately equal on both sides of the V-bar and at the counter-bearing bar. In practice, they rarely are -- the V-bar is usually symetrical to a centerline through the Capo d'Astro bar and the counter-bearing bar angle of incidence is usually quite small and often varies throughout the treble section. If you're trying to improve a plate with particularly troublesome string noises, a good place to start is on the "back" side – i.e., the side toward the tuning pins – of the V-bar, then moving up to the counterbearing bar.

Note 2. The String Deflection Angle.
For tuned duplex string segments of this length, indeed, for any duplex string over 15 to 20 mm, this should be considered the minimum acceptable string deflection angle. In general, to be relatively free of objectionable string noises, longer duplex strings need greater string deflection angles than do shorter duplex strings.

Note 3.
The minimum required angle of incidence is somewhat dependent on the radius of the V-bar or the counter-bearing bar and on the hardness of the material from which they are made. In general, the larger the radius, the greater the angle of incidence must be. V-bars made of harder materials can use a slightly smaller angle of incidence if by the design, but harder V-bar materials can also contribute to string breakage problems. The angle of incidence between the string and the counter-bearing bar is just about as important as it is between the string and the V-bar.

Note 4. The V-bar and Counter-bearing Bar Radius.
The "correct" radius for the bottom of the V-bar and for the top of the counter-bearing bar is somewhat dependent on the hardness of the V-bar material – bars made of harder materials can tolerate a slightly larger radius -- and on the angle of incidence, However, it should never exceed 1.5 mm (0.060", or approx. 1/16") regardless of either the material used or whether or not tuned duplex string segments are used. The radius of the "speaking" side of the counter-bearing bar is just as important as that of the V-bar.

Figure 1. This drawing is a cross-section of a typical grand piano plate with a "tuned" front duplex string segment. In this case the duplex string segment is tuned to the same frequency as the speaking frequency. This arrangement will be very susceptible to string noises unless both the V-bar and the counter-bearing bar are carefully shaped and all string angles are maintained to at least the minimum specifications indicated. Even so, in time, there are likely to be various string noises that will require attention.

Figure 1

the string offset and deflection angle. (See Figure 1.)

That this rarely works well in practice is due to a number of variables that are difficult, if not impossible, to control.

First, the difficulties of precisely casting the counter-bearing bar in relation to the V-bar makes it virtually impossible to cast a counter-bearing bar in the exact position needed to accurately tune the duplex string segment to any specific frequency.

When piano plates are cast, hot, liquid iron is poured into an "upside down" mold in what is called a "drag." The drag is filled with "green," or slightly damp, sand into which the pattern has been imprinted. The Capo d' Astro bar (but not the V-bar) and the counter-bearing, or duplex bars, are located in this part of the mold along with all the rest of the top detail of the plate. The bottom detail of the plate, including the V-bar, is in the "cope," or the upper part of the mold. Precise alignment of these two parts of the casting mold is very difficult to achieve, even using the most sophisticated casting processes. Even if the cope-to-drag alignment is perfect, as the casting cools it will shrink, and while shrinking it will bend, twist and warp to an astonishing degree. Both of these problems — cope-to-drag alignment and cooling stresses — combine to make accurate alignment of the V-bar and counter-bearing bars an elusive goal at best.

Once the casting is cool, both the V-bar and the counter-bearing bars are machined. Historically, this was done by hand with the shape, not the precise position, being the important criterion. Even now, with most of this work being done by computer controlled machines, it is still somewhat problematic. The counter-bearing bars are on the top of the plate and are machined with the plate right side up. The V-bars are on the bottom of the plate and are machined with the plate upside down. There inevitably are minor discrepancies in indexing between the two operations. Since it only takes a fraction of a millimeter to throw off the duplex tuning, it is no wonder that it is rarely done correctly.

Providing adjustable duplex bars doesn't help much either. Because of the strings' friction across the bearing points, even if the counter-bearing bars are installed and adjusted with adequate precision, equalizing the string tensions in all of the various string segments in each of the three strings of a typical unison just doesn't work very well in practice. Tune the string and the duplex segment is off, adjust the duplex bar and the tuning goes out, etc., etc., etc. Perhaps you can begin to understand some of the problems that makes tuning these duplex string segments and keeping them tuned impossible in any practical sense.

Casting and machining problems aside, providing a mechanism which encourages the duplex string segment to vibrate at all is really the source of our problems with zinging strings. Basically, most string noises come from one of three potential sources:

1) The speaking portion of the string vibrating against the front profile of the V-bar.

2) The duplex portion of the string vibrating against the back profile of the V-bar.

3) The duplex portion of the string vibrating against the front profile of the counter-bearing bar.

A fourth source for objectionable string noises, though not technically a "buzz" or a "zing," is the dissonant beating of an out-of-tune "tuned" duplex string segment. These can be just as obnoxious as any of the buzzing noises caused by the first three, and are often even more difficult to control.

For tuned duplexing to work at all, the string must "pivot" across the V-bar. For the string to pivot across the V-bar without creating objectionable noises requires a V-bar profile with a fairly small radius, something on the order of R = 0.75- to 1.5 mm depending on the hardness of the V-bar material. (See Figure 1, Note 4.) Usually, most of the work done on the V-bar shape is done on the speaking side of the V-bar. Unfortunately, most of the zinging comes from the duplex side of the V-bar. To keep string noises to a minimum, the shape of the back side (that facing the keys) of the V-bar is perhaps even more important than the front side. Sadly, this is pretty much ignored by many piano builders.

When the string deflection angle and the V-bar profile are correct (assuming that the duplex length is exactly right), the duplex string segment does vibrate more or less in sympathy with the fundamental and can increase acoustical power, at least to some extent. But, is it "free?" Unfortunately, Ed McMorrow's observation that the front duplex is actually "sucking energy out of the speaking length" is absolutely correct. Since there still ain't no free lunch, not even in piano design, we need to consider what this "free" power is costing us.

In this case, the price we pay for a very slight potential increase in power — in addition to all the string noises that accompany it — is a measurable loss of sustain. I realize this is contrary to the fairly popular conception that tuned duplex string segments aid both power and sustain. I've simply not found this to be the case, either experimentally in controlled tests, or empirically, through observation. In any given real-world vibrating string of a fixed mass, length and tension, there is a finite amount of potential energy. All things being equal, acoustical power and sustain are inversely related. You can increase power at the expense of sustain, or you can increase sustain at the expense of power. But you can't have it both ways.

There is only so much energy that can be transferred from the hammer into the string. Among other things, it is limited by the mass of the hammer and its velocity at impact. If the duplex string segment is working according to theory, it must bleed energy from the speaking portion of the string. This energy is then lost to the soundboard. True, a little bit of the energy in the duplex section will be fed back into the speaking portion of the string, but most of it will be dissipated into the plate. Alas, cast iron piano plates make fairly poor soundboards.

As pointed out in the Roundtable Discussion, the extraneous noises can sometimes be eliminated, or at least reduced, by lightly damping the duplex string segment. Placing a finger lightly on the duplex string segments, or lightly felting them, will often quiet them. Unfortunately, this has the same influence on sustain as placing a small damper directly on the speaking portion of the string immediately adjacent to the V-bar. It will reduce the sustain time of the tone considerably. By keeping the duplex string segment very short and presenting a more solid speaking length termination, the vertical piano's design prevents this

Continued on Next Page

The Designer's Notebook — Front Duplex Stringing Scales

Continued from Previous Page

loss of energy across the V-bar. By keeping the vibrating energy in the speaking length of the string sustain is, potentially at least, improved.

So what is all this leading to? Front duplex string tuning may give a piano slightly more power. It also reduces sustain, and inevitably makes a piano more susceptible to string noises, buzzes, whistles, zings and what-have-you. It is true that these noises can usually be controlled by paying careful attention to the V-bar and counter-bearing design parameters. And if they develop anyway, they can usually be made less objectionable by dampening them out using some of the techniques mentioned in the Roundtable Discussion.

There is another way, at least from an original design standpoint. These problems can be eliminated by deliberately ignoring front duplex string tuning and keeping the duplex string segments very short. Blocking the energy transfer across the V-bar to the duplex string segment in the first place is a much more efficient process than trying to dampen it once it's there. Since most, if not all, of the objectionable string noises are coming from the duplex string segment and not from the speaking segment, and since the advantages (assuming there are some) are so relatively minor, perhaps the piano is trying to tell us something!

String Breakage

What about all those potential string breaking problems? One of the advantages of the tuned duplex scale design is supposed to be that, by allowing the string to "pivot" over the V-bar the string is not forced to bend at the V-bar, hence reducing work-hardening and increasing string life. Again, let's go back to the vertical piano design as a comparison. It can't really be said that the strings pivot over the vertical's V-bar. The combination of the string deflection angle and the relative short string segment between the V-bar and the pressure bar effectively preclude this, so they're forced to bend. And in spite of all of this bending, strings don't break with any more regularity on verticals than they do on grands with similar stringing scales. So, I have to believe there are other contributing factors that encourage strings to break. Two that come readily to mind are the hardness of the V-bar material and the mass and hardness of the hammer.

As a rule of thumb, the V-bar material should be somewhat softer than the string material. Cast iron works fairly well if it is shaped properly. Brass wire seated in a cast-in groove is good, as is soft steel wire. Hard steel wire is asking for trouble. Inverted half-agraffes (brass, as used on some old Chickerings) are also very good. An idea I've used on a couple of otherwise quite different grand piano designs in the past few years is to have the V-bar cast as a separate part out of either manganese bronze or silicon bronze. Both materials are harder than cast iron and softer than music wire. And both allow the string to render over very smoothly during tuning. So far, this is my favorite. It's simple and adjustable, that is, the builder can locate it to a template during assembly to ensure that it is located properly. Also, since it is a much smaller casting, the bronze foundry has much greater control over the shape of the V-bar profile.

The mass of the hammers in the treble section should be appropriate to the scale. Most of the hammers put on new pianos today are much too hard and massive, especially in the treble section, and especially on grand pianos. Typically, vertical pianos will have lighter and/or softer hammers than will grand pianos of similar scale size. Notice, I didn't say larger. Size is not the relevant factor here; mass and density are. Harder and heavier hammers cannot successfully make up for poor basic design or for a lack of adequate attention to detail during manufacture.

Duplex, or Not Duplex... ?

All of this brings back the question of the desirability of front duplex tuning. As with most design principles, I always like to try to determine why they came into being in the first place. This one was developed during the late 1800s in an attempt to enhance the power and projection of the tone through the upper tenor and treble sections of grand pianos. It was later adapted to vertical piano designs as well, but with such disastrous results it was abandoned by nearly all manufacturers by 1920 or 1930.

Instruments built during the years that the "modern" grand piano design was evolving incorporated a number of fundamental design limitations because many of the basic concepts of piano acoustics were not fully understood. To some extent they still aren't. In addition, there were limitations in some of the materials available at the time that forced design decisions limiting power and sustain in the upper tenor/treble sections. At least some of these limitations have been overcome with the materials available today.

If many of the reasons for these design limitations no longer exist, why do the designs resulting from them continue on? In other words, if the acoustical limitations that led to the invention of the tuned duplex system no longer exist, why are they still featured in nearly every grand piano built today, even though they demonstrably don't work very well in practice? Modern piano design seems to be driven by tradition more than any other single factor. Consequently, most of the grand pianos in production today remain, to a greater or lesser degree, copies of, or at best, simple refinements of design concepts worked out during those early years of development. And so we still remain stuck with many of their acoustical limitations.

So, should we still be using tuned duplex string segments in modern pianos? I think we can make a good case for abandoning the practice. Generally, I have found it easier to design clean and powerful treble sections — complete with good sustain — by deliberately avoiding tuned duplex string segments. The Fandrich Vertical Piano, for example, does not have front-tuned duplex tuning, yet I found it necessary to use 72 dampers, rather than the normal 67 or 68, because the sustain was simply too long to be allowed to die out naturally. Indeed, I considered at one time specifying 75 dampers for the design.

My personal belief is that better-sounding upper tenor/treble sections can be designed without duplex tuning than with it. Done well, they can be both more powerful and have longer sustain.

(Note: *I should point out that there are a number of different design elements involved here. For a variety of reasons that I'm not going to go into here, it is easier to design a good treble section in vertical pianos than it is in grand pianos. This is one area where the vertical piano performance should be clearly superior to the grands. The low bass in pianos of equal scale length is another. A subject for another time.)*

Conclusions

Caution! *The following conclusions are my own, but they are based on more than 30 years — never mind how many more — of piano building and rebuilding experience, and are drawn from the results of a variety of different experiments I have conducted over the past 15 years, as I have become increasingly involved in piano design as a profession. They are based on the knowledge I have as of the day I'm writing this. It is not intended to be an inclusive, or complete, list. Also, I reserve the right to change my mind as I continue to learn more about how the piano really works.*

String Termination Angles

There is no "correct" string termination angle. There is an appropriate range, dependent on the overall design of the plate scale:

- String termination angles must be sufficient to clearly define the speaking length of the string. For duplex string segment lengths of 15 to 20 mm, this should be a minimum of 12 degrees. The longer the duplex string segment, tuned or not, the greater the string termination angle will need to be.
- String termination angles must not be so great that string friction across the various bearing points becomes a problem. For duplex string segment lengths of 15 to 20 mm, this should be a maximum of around 18 degrees to 20 degrees.
- For most vertical piano designs, a good starting point will be 15 degrees at C-88.

String Noises in Vertical Pianos

String noises of the type discussed in the Roundtable mentioned earlier are rarely found in vertical pianos. When they are, it is almost always because a tuned duplex stringing scale is used or because the V-bar is very badly shaped. Occasionally, a poorly seated V-bar wire insert can give problems if the groove in the V-bar is not well cast or machined.

String Noises in Grand Pianos

Objectionable string noises (zinging strings) are almost always created in the duplex segment of the string and are found most often in pianos using tuned duplex string segments. In general they are caused by the string vibrating against either the front or the back of the V-bar surface or against the front surface of the counter-bearing bar.

- The radius of the V-bar profile is too large.
- The radius of the counter-bearing bar profile is too large.
- The V-bar material is too soft allowing the string to form too large a groove in the surface of the profile.
- The angles of incidence are not great enough. (See Figure 1, Note 1.)

The Length of Duplex String Segments

Tuned or untuned, the length of the duplex string segments is one of the primary factors determining a given piano's propensity toward developing unwanted string noises. Shorter duplex string segments are less prone to unwanted string noises. Longer duplex string segments tend to create or at least encourage them.

V-bar Shape

The shape of the V-bar should be a radius of 0.75 to 1.5 mm, depending on the hardness of the material used and the string deflection angles used.

Counter-bearing, or Duplex Bar Position

Even if it were possible to cast, or otherwise position the duplex bearing bar in its mathematically correct position, it would still be practically impossible to maintain duplex tuning over any practical period of time because of string friction against the various bearing points.

String Breakage

The shape of the V-bar is not the major factor contributing to breaking strings. String breakage is primarily dependent on:

- Excessive hammer mass.
- Excessive hammer hardness or density.
- Hardness of V-bar material; the V-bar material should be softer than the string.

Acoustical Power vs. Sustain

Duplex tuning, when it is working properly, can increase power marginally; in the process, it decreases overall sustain in proportion to the increase in power. (The sustain of some partials may increase, others will decrease for a net loss of sustain time.)

Advantages & Disadvantages of Tuned Duplex String Segments

Pianos using imperfectly tuned duplex string segments will generally have:

- A possible slight increase in initial attack power.
- Shorter sustain.
- Problems with string noises are inherent characteristics of the design.
- Much greater sensitivity to the shapes of the V-bar and counter-bearing bars.
- Somewhat greater sensitivity to the hardness of the material used in the V-bar.

The 60-Second Temperament

Dan Levitan, RPT
Contributing Editor

In this month's article — the last, I promise, in this endless series about the temperament — I'd like to present a quick and dirty temperament sequence that unfailingly produces a temperament of at least minimal acceptability. "Unfailingly" is a dangerous word to use in relation to temperament sequences, but this is the most foolproof one I know of. It's not precise enough for doing really fine work, but it's a handy sequence to know when, whether by choice or necessity, you must produce a tuning in as little time as possible. It might also prove useful if, in the depths of the temperament on a horrible little piano, you find yourself impossibly lost and confused.

To me, a minimally acceptable equal temperament is one in which all the fourths and fifths are on the correct side of pure, and none of them beat objectionably fast. I guarantee that this sequence will get you there in sixty seconds. If you have the luxury of a little more time, you can go through the sequence more carefully, checking thirds and sixths as you go, even setting an exact octave size, and it will usually reward you with quite a presentable temperament.

The most common example of a tuning that must be done at top speed is, of course, a chipping or other rough pitch adjustment. Not only is it a waste of effort to labor over the temperament on a piano that's about to be sharpened a hundred cents; the effort that you put into it will rob you of your enthusiasm for tuning a fine temperament on that piano later on when it is called for. I don't know about you, but I just hate to fine-tune any string on a piano more than once, and I find that when I pitch-adjust using my usual temperament, I tend to get bogged down in the details, spend more time than I should, and ultimately waste time doing too good a job for the situation.

Aside from pitch adjusting, we probably all find that no matter how carefully we may try to regulate our schedules, how devoted we are to maintaining the highest standards, how high our rates are, or how even-tempered we may be, there are times when we simply haven't got the time to do our best tuning, and even times when doing our best tuning is simply not appropriate or in the best interests of our clients. The conditions under which we work make it inevitable.

We need to schedule enough work each day to earn a living, yet at the same time we must arrive on time to each job, give each client our best work, and deal with unexpected emergencies as they arise. We would like to spend as much time as necessary with each piano we see to bring it to its fullest potential, yet we have to recognize not only our time constraints, but also the financial constraints that our clients face, and give our clients the best value for their dollar. We rely on other people to give us reasonably accurate information about their instruments and to meet us at particular times; but try as we might to avoid surprises and scheduling problems, sometimes circumstances beyond our control box us into difficult or impossible situations.

The result is that we often have to make quick decisions about how to make the best use of our time and our clients' money in order to maximize the benefit to everyone. The more flexible our approach, the more we'll be able to do our best work under any circumstances. That means having at our command a broad range of tuning techniques, and gathering the experience that will let us know in advance what sort of results we can expect from each of those techniques. Here's one more tool for your kit. As usual, I will assume that you already have a basic working knowledge of temperament tuning — which intervals are tuned wide or narrow, their approximate beat rates, interval tests, and so on. If not, this material is available from a variety of sources, such as William Braid White's "Piano Tuning and Allied Arts" and the PTG Tuning Exam Sourcebook.

The 60-second Temperament

This temperament sequence tunes only twelve notes, F3 to E4. At five seconds per note, that works out to sixty seconds.

First, a brief overview of the sequence of the three stages:

Stage 1: Tuning the three notes A3, F3, and C#4 as the major thirds F3-A3 and A3-C#3.

Stage 2: Tuning the notes a fourth and fifth away from these three notes: G#3 and F#3 (to C#4); C4 and A#3 (to F3); and E4 and D4 (to A3).

Stage 3: Tuning the remaining notes as fourths or fifths balanced between the notes tuned in Stage 2: G3 (to C4 and D4); D#4 (to G#3 and A#3); and B3 (to F#3 and E4).

Here's a quick way to get through the sequence:

Stage 1

1. Tune A3 right to your A-440 fork. Don't bother to tune A4 first and go down an octave. Don't bother to use a test note, either. I promise you'll be close enough. Of course, if it's a pitch adjustment, compensate in your usual way.

2. Keep a finger on A3 and tune F3 to A3 as a wide major third at 6-7 beats per second. Use your experience and best judgment here, but don't fuss.

3. Keeping a finger on A3, tune C#4 to A3 as a wide major third at 9-10 beats per second.

Stage 2

4. Keep a finger on C#4 and tune G#3 to C#4, a slightly wide fourth. Don't use your tests — just listen to the sound of the fourth. One way to do it is to flatten G#3 until the fourth is beating, bring G#3 up to the point that the fourth is just pure, and then let G#3 relax down a bit to widen the fourth just a tad.

5. Stay with C#4 and tune F#3 to C#4, a slightly narrow-sounding fifth. Don't worry if it's a temperament where you suspect the fifth might have to be wide at the 3:2 level. It will still sound narrow if it's only narrow at levels 6:4 and higher.

6. Now drop your whole hand down a half step and tune C4 to F3, a slightly narrow-sounding fifth.

7. Keep a finger on F3 and tune A#3 to F3, a slightly wide fourth.

8. If you dropped your hand down

a half step now you'd play the fourth E3-A3. Instead, drop down the half step and at the same time jump the E3 up an octave and tune E4 to A3, a slightly narrow-sounding fifth.

9. Keeping a finger on A3, tune D4 to A3, a slightly wide fourth.

Stage 3

10. Keep your finger on D4, and tune G3 to balance between the fifth, G3-D4, and the fourth, G3-C4. Don't worry what side these intervals are on, just make sure they're both reasonably quiet. Finish with your hand on the fifth, G3-D4.

11. Move your hand up a half step and tune D#4, to balance between the fifth, G#3-D#4, and the fourth, A#3-D#4. Finish with your hand on the fourth, A#3-D#4.

12. Move your hand up another half step, and tune B3 to balance between the fourth, B3-E4, and the fourth, F#3-B3.

Done! All the fourths and fifths are reasonably quiet because you tuned them that way. No chain of fourths and fifths is more than two intervals long, so there's been little chance for errors to accumulate. And very likely the fourths and fifths you tuned in Stage 3 are on the correct side of pure.

Now check your thirds. They're probably pretty ragged. It usually pays to spend an extra minute checking your thirds and sixths as you go in order to come up with a better temperament. You'll regain more than that minute later on if you plan to test your octaves, whether with fourths and fifths or thirds, tenths, seventeenths, and twenty-fourths. Here's how to do it:

Stage 1

Again, set your A3 straight to the A-440 fork. This time you might want to use a test note. After you tune F3, add an extra note to the temperament by setting the octave F3-F4 before you tune C#4. This will give you a more reliable sense of your chain of major thirds (F3-A3, A3-C#4, and C#4-F4). Alternatively, start with an F fork, tune F4 directly to it, tune down an octave to F3, and then put in the A3 and C#4.

Stage 2

If you can allow yourself a little extra time in this stage and the next one, you may find it useful to check the width of your fourths and fifths with the usual tests. Each note in this stage can also be checked as a minor third — or as its inverse, a major sixth — with one of the notes that were tuned in the previous stage. The minor thirds in the upper end of the temperament are so fast that it's difficult to hear them accurately, but great accuracy is not called for. Just satisfy yourself that they're not impossibly slow or fast.

In addition to the minor thirds/ major sixths, major thirds also become available to check in this stage after the first pair of fourths and fifths are tuned.

— Check G#3 as a minor third, F3-G#3, and/or as a major sixth, G#3-F4.
— Check F#3 as a minor third, F#3-A3.
— Check C4 as a minor third, A3-C4. Also check the major third, G#3-C4.
— Check A#3 as a minor third, A#3-C#4. Also check the major third, F#3-A#3.
— Check E4 as minor third, C#4-E4. Also check the major third, C4-E4.
— Check D4 as a major sixth, F3-D4. Also check the major third, A#3-D4.

Stage 3

Each note in this stage can be checked as a minor third/major sixth against two notes from the previous stage.

— Check G3 as a minor third, G3-A#3, and as a major sixth, G3-E4.
— Check D#4 as a major sixth, F#3-D#4, and as a minor third, C4-D#4.
— Check B3 as a minor third, A#3-B3, and as a minor third, B3-D4. Also check it as a major third, G3-B3, and as a major third, B3-D#4.

And that's all there is to it. There's a lot this simple sequence can't do. It won't, for example, allow you to easily adjust beat rates to the inharmonicity of the piano at hand, but I do hope that it proves useful to you someday when the chips are down.

One of the pleasures of writing for the *Journal,* I am discovering, is getting feedback from the magazine's readers. Many thanks to all of you who've taken time from your busy lives to offer your observation on topics I've addressed as well as on related subjects.

Just as I was about to send this article in, I received a call regarding the April issue from Mr. John Schulstad, a PTG member in Minnesota. He made several comments which I would like to pass along.

Most importantly, Mr. Schulstad pointed out an error, for which I am responsible, in my article in that issue. At the top of the third column on page 29, please note that the first line should read "major sixth, C#3-A#3", not "major sixth, C#3-F4." Mea culpa — that's how it was on my disk. (*If you think that reading this stuff makes your head spin, try proofreading it!*)

Mr. Schulstad also offered an interesting definition of expanded and contracted intervals, which clarified for him some of the things in that, as well as some previous articles: An interval is expanded when the coincident partial of the lower note is flatter than that of the upper note, and contracted when the coincident partial of the lower note is sharper than that of the upper. Quite true; understanding that is a necessary prerequisite to understanding how inharmonicity affects beat rates.

I'm grateful to Mr. Schulstad for his comments; please, feel free to contact me if you have any comments, and note that my address has changed since the 1994 Membership Directory. It's now 530 First Street, #6, Brooklyn, NY 11215; it should be correct in the 1995 Directory.

PACE

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LESSON PLAN

Technical Lesson #23

Grand Regulation - Part 4: Spacing, Squaring & Leveling

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 will cover the proper alignment of the keys; namely, even spacing, squareness, and level. After replacing keyframe felt or when working on older pianos, the correct key height must be reestablished. Such major re-leveling is beyond the scope of this lesson. Instead, we will focus on touching up the key alignment on new or almost new pianos where level, squaring and spacing have simply settled slightly.

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 grand pianos in good condition. New or almost new pianos on a showroom floor are ideal. Basic key height should be correct, with only minor refinement of the leveling needed.

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

2 hours.

Tools & Materials Participants Must Bring

For this lesson, participants should bring the following:

- Short key leveling straightedge (APSCO #15431, Pianotek #JSE-1, Schaff #R-26; 1/4" x 1" aluminum bar, 15" – 18" long from hardware store also works well).
- 8" –12" tweezers (such as Schaff #160C or #160D, APSCO #15092 or #15418, Pacific #13-49).
- Centerpin cutters or small scissors.
- Assortment of balance rail paper punchings.
- Key spacing tool.
- 6" machinist's rule.
- Small moving blanket or pad for stretcher.

Assigned Prior Reading for Participants

PTG Technical Exam Source Book, pages I.1; I.8 – I.9; September 1993 PT *Journal*, pages 38 – 41. A highly recommended resource is Yamaha's video & book set, *Grand Regulation in 37 Steps*, available from Schaff Piano Supply and Yamaha Corporation.

General Instructions

Level, evenly spaced keys set at the correct height are fundamental. To the action regulator, correct key height ensures a proper fit between the keys and the keypins, keyslip and fallboard. Key height also influences action leverage, as explained in the assigned reading. All keys must be square (top surface parallel to the keybed; not tilted) and even in height in order to allow accurate adjustment of key dip and, therefore, aftertouch. To the pianist, square and level keys provide an even playing surface free of tactile and visual distractions.

A complete regulation job on an older piano or after keyframe felt replacement would involve first determining the correct height for both naturals and sharps. Then, all keys would be leveled to those samples. This lesson will address the simpler case of a newer piano with key height correct but only needing refinement. This would be the typical scenario for a new piano or one with only a few years of wear.

Key Leveling Methods

1) Action stack removed: One common method of key leveling involves removing the action stack from the keyframe, and attaching key leveling leads to the keys. These lead weights take the place of the action parts and hold the keys in the "up" position for leveling. With the action removed, keys can be quickly lifted off the balance rail pins to insert paper punchings, just as in vertical pianos.

Advantage: Inserting or removing paper balance rail punchings is faster and easier with the action removed.

Disadvantages: Removing the action and installing the lead weights is time-consuming; accuracy is reduced since the keyframe may distort slightly when the stack is removed, and because the lead weights do not exactly match the weights of each individual wippen and hammer assembly; some fine adjustment will usually be required after the action is reassembled.

2) Action fully assembled: Another method is to leave the action stack in place, stand the action up on its backrail, and insert "split" paper punchings around the balance rail pins from the underside of the keyframe. All punchings to be installed are first split and temporarily inserted partly under the *front* rail punching of their respective keys (so they stay in place when the action is lifted up). Then the action is stood up and all are inserted.

Advantages: Accuracy is improved because level is checked with the actual weight of the action parts pressing on each capstan, and because the action stack holds the keyframe in the proper shape; this method is very fast for touch-up leveling (20 or 30 punchings can be inserted in the time it would take to remove the action stack and install the key leveling leads).

Disadvantage: If key height is being set from scratch, requiring several punchings to be inserted under each key, it is faster to do the rough leveling by method 1 (or some variation of it), then fine-level with method 2.

Method 2 will be described in this lesson. Like any new technique, it takes a little practice to master. However, its speed and accuracy make it well worth the effort.

Straightedges

A long (48") straightedge that spans the entire keyboard is most convenient when changing key height and doing a complete re-leveling. The two end keys are used as samples, propped up to the desired height to support the weight of the straightedge. Then punchings can be laid out in front of all low keys at once.

A short (12"–18") straightedge has advantages, especially for field work. It is small and easy to carry to the job, is easier to obtain in the first place, and is convenient to pick up for bumping balance rail pins when squaring. Incorporated into the tool kit, it also becomes a convenient straightedge for aligning other action parts. For touch-up leveling, there is usually no need to prop up sample keys to support this short, lightweight straightedge.

When touching up the key level, the short straightedge is just placed at different spots along the keyboard to check for low or high keys. For more major key re-leveling, several sample keys are set to correct height, and the straightedge spans between them.

Necessary Prerequisites to this Work

■ Keys must first be properly eased at the balance and front rail bushings, and at the balance rail pin holes (easing the key bushings later will affect the squaring and spacing slightly). Excessively worn key bushings will compromise the accuracy of the spacing, squaring, and leveling that can be done, since wobbly keys can "float" to various positions.

■ Keyframe bedding must first be correct.

■ Capstans must be adjusted so all hammers are up off of the hammer rail or wippen rest felts, so the action part's full weight rests on the capstans.

■ The back rail cloth should be free of debris. *If one or more keys are conspicuously low*, check for wood chips or other debris between those keys and the backrail cloth.

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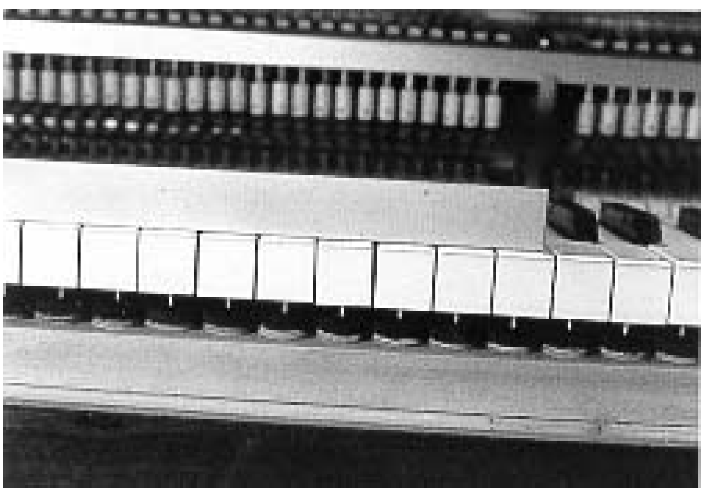

Photos 1 (above, left) & 2 (above, right) – Key squaring: Look for any keytops not parallel to the straightedge, as shown in Photo 1. Correct by bending the balance rail pin to one side to stand the key up straight. A short straightedge makes a convenient squaring tool, since it is already in hand. Otherwise, use a soft metal or wooden drift to avoid nicking the balance rail pin. Be careful not to damage the key buttons. Square both naturals and sharps. Note that key squaring changes the clearance between keys; in the case of a warped key, squaring the front end of the key may create a clearance problem at the back of the key.

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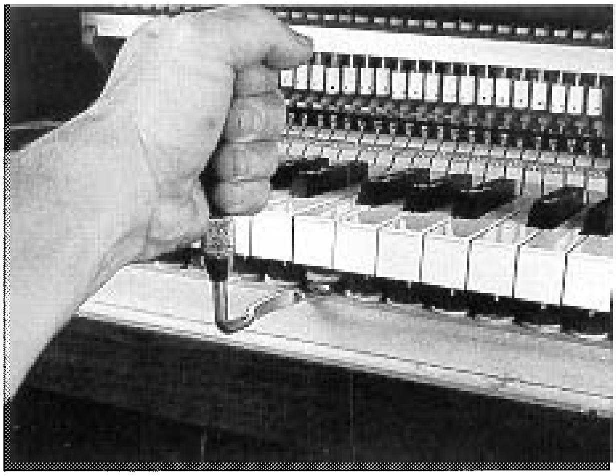
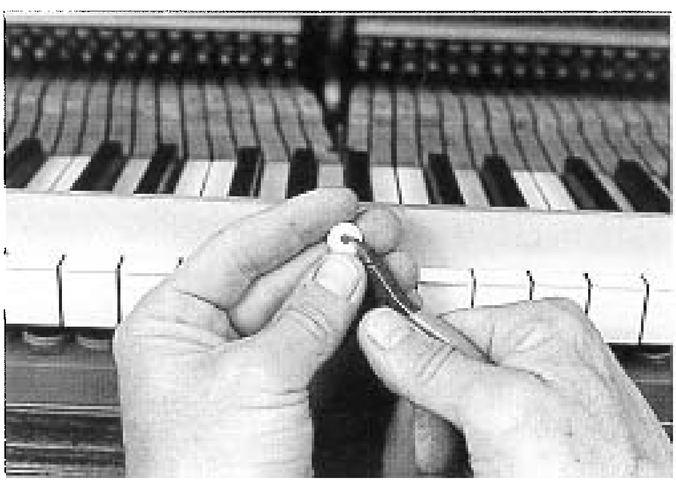
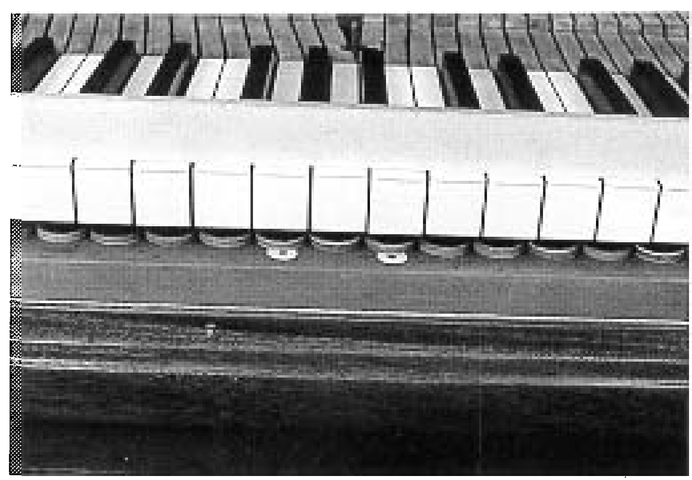


Photo 3 (above) – Key spacing: Inspect for even spaces between natural keys. Correct by bending the front rail pins side-to-side as necessary. After the naturals are done, space the sharps to center them in the spaces between the naturals. To avoid damaging the bearing surface of the front rail pins, always place the tool under the front rail punchings. As with key squaring, spacing affects clearance at the backs of the keys. The tool shown has had two modifications: first, the handle has been bent at a right angle so it works by leaning rather than twisting; this gives much better leverage, making it much easier to use on stiff pins. Secondly, the front end of the tool (not visible) has been ground to a bevel, making it easy to slip under the front rail punchings.

Photo 4 (below) – Checking key level with the short straightedge: Check for any natural keys that are too high by lifting one end of the straightedge slightly and dropping. Repeat with the other end of the straightedge. Place a chalk mark on the keyframe in front of any keys that wink, indicating they are too high.





Photos 5 (above, left) & 6 (above, right) – Laying out punchings for low keys: Look for any gaps between the natural keytops and the straightedge. Choose a paper punching one-half the thickness of the gap, and slit the punching with scissors or centerpin cutters as shown in Photo 5. Slide the slit punchings part way under the front rail punchings of their respective keys. (Note: it is easiest to stack up several punchings of a given thickness, hold them in the fingertips, and clip them all at once, rather than clipping each one as needed.)

PACE

Professionals Advance through Continuing Education

LESSON PLAN

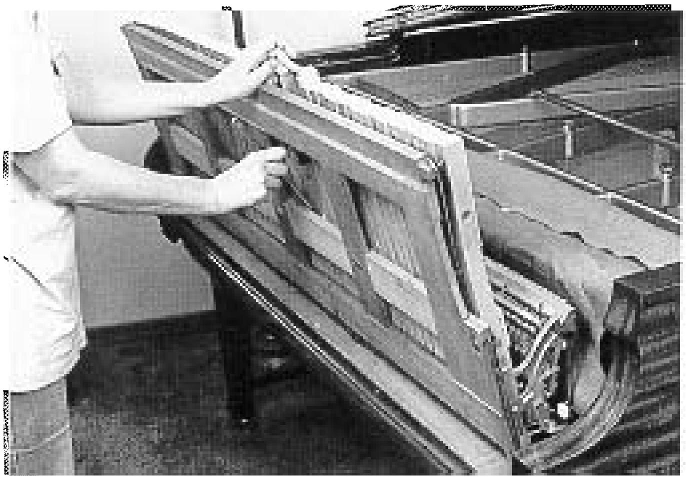


Photo 7 (above) – Inserting/removing punchings: Once all high keys are marked and all needed punchings are laid out for the low keys, stand the action up on the keybed and make the adjustments from the underside of the keyframe. Note the blanket padding the stretcher to prevent damage from the drop screws.

Photo 8 (above) – Hand positions (assuming a right-handed technician): Balance the action by holding the front rail with the palm of the left hand, then use the middle finger to raise the key to be leveled. Then, insert a split paper punching if the key is low, or tear out a paper punching if the key is too high.

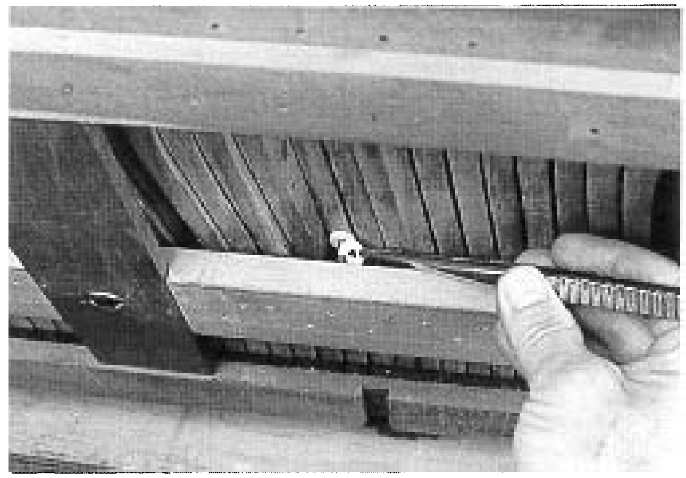


Photo 9 (above) – Close-up of inserting a split punching: With the index finger of the left hand, slide the split punching from under the front rail punching out to the edge of the keyframe. Grab the split punching with the tweezers, and bend the cut edges away from each other so the punching is in the shape of a spiral (this opens up the split in the punching, making it easier to insert). Slip the punching onto the balance rail pin. When all changes have been made, slide the action back in position and recheck key level. Lay out punchings again as needed to further refine the level. When the naturals are level, repeat the procedure for the sharps.

Conclusion

Although all regulation adjustments are important, not all are as obvious to the pianist as a level, even keyboard (or lack thereof). This method of leveling keys with the action completely assembled, and using a convenient, short straightedge, gives the technician the capability to accomplish the job quickly in any circumstance.

PACE

Professionals Advance through Continuing Education

LESSON PLAN

Tuning Lesson #23

Single Octave Tuning in the High Treble

By Michael Travis, RPT

This monthly lesson plan series 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 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 the top octave, the range of C7-C8. Participants will learn and practice some tests and techniques for performing the "clean single octave" type of high treble tuning, as required on the PTG Tuning Exam.

Chapter Meeting Setup

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.

This lesson requires that the piano be strip muted and that single strings at least from C3-B6 be in tune. Notes C7-C8 should be detuned alternately sharp and flat, by a noticeable amount, as if for a tuning exam. Any false beats should be corrected as much as possible by the usual methods.

Tools & Materials Participants Must Bring

Tuning Hammer.

Home Study Assignment for Participants

Read and study "The PTG Tuning Examination: A Source Book," pp 49-53, "Learning to Pass the PTG Tuning Exam, Part 8: High Treble." Also, read Rick Baldassin's "Picasso Tuners," pp 119-21; the graph referred to which accompanied the original article is on p. 22 of the 4/88 *Journal*. For a broader perspective, read Kent Swafford's "Temperament to the Top," in the 7/94 *Journal*, pp 27-29. Review PACE Tuning lesson #7, "Tuning 2:1 Octaves," 3/94 *Journal*, and practice using the M10-M17 test to check your single octave tuning. In the high treble, the M17 should beat no more than about 1-2 bps faster than the M10 to meet PTG Tuning Exam requirements. Also practice tuning the high treble using the single octave resonance test.

General Instructions

Make sure the piano is prepared as described above. Each participant should have three notes to tune. The instructor should demonstrate at least the first four tests in the list accompanying this lesson by tuning A6, A#6 and B6. Pay particular attention to test #2, the single octave resonance test, and make sure participants understand how it works. The first participant should then tune C, C# and D in octave 7, applying the same techniques and tests. Once all participants have had an opportunity to tune, the instructor can demonstrate some of the other tests, and participants can use the balance of the time to take turns on detuning and retuning particular notes.

If an electronic tuning device and some extra time is available, here's another option: play a simple aural tuning game called "beat the box." The instructor measures the second partial of four successive octave 6 notes, detunes the corresponding octave 7 notes from pure 2:1 octaves by the same number of cents, and each participant then tries to tune a pure single octave from his/her note up to octave 7, using only aural tests. The octave 7 notes should be de-tuned exactly the same amount for each "contestant," and the "fans" should be quiet during each "game," saving their cheering for later. Anybody who can aurally tune a clean single octave no more than 2¢ wide three times in a row should get a nice round of applause, since they have "beat the box."

If still more time is available, have each participant tune a few unisons to their respective middle strings. High treble unisons are among the most challenging to tune of any on the piano, and some extra supervised practice on high treble unisons would be worthwhile. The instructor should demonstrate how to do it, and how to use a plucking technique to judge the pitch of side strings that do not sound clean.

Tuning Tests and Techniques for Octave 7

1. Tune as a beatless to slightly wide single octave, playing both notes together.
2. Fine tune to the single octave resonance pitch with the open, unplayed string one octave below (depress the lower octave note silently while playing the upper octave note, moving the pin slightly up and down and listening for the resonance, which will sound like a sudden spike in the volume and/or sustain of the high treble note).
3. Check with the M10-M17 test, both on individual octaves and, to judge consistency of octave tuning, apply the test in parallel series on adjacent octaves; M17>M10 by about 1-2 bps.
4. Check parallel M17s for uniformity.
5. Check with M3-M17 test; M3≥M17 in the top octave when tuned as clean single octaves (pure to narrow double octaves). If reversed, the note is sharp.
6. Check with M6-M17 test; M6>M17 in the top octave when tuned as clean single octaves (narrow twelfths). If reversed, the note is sharp.
7. Play a "chord of nature" appeggio: with the left hand, the double octave-fifth, the M17, the double octave, and the octave fifth, which comprise a minor chord, and, with the right hand play the octave, followed by the note your tuning. This gives you the following interval ratios: 6:1, 5:1, 4:1, 3:1 and 2:1.
8. Check the ascending major scale tetra chord: do-re-mi-fa ("fa" is the note in question) to help show tuning discrepancies when false beats are present, or to locate yourself if "lost."
9. Check with the P12-P19 test: the octave

fifth should beat slower than the double octave fifth in the top octave when tuned as clean single octaves. If reversed, the note is sharp.

Background

The type of high treble tuning we are practicing here is a type that is useful for the PTG Tuning Exam, and may or may not be to anyone's personal liking. There is a good deal of room for subjectivity about what degree of octave stretching is most appropriate for particular situations, such as a home or a concert hall, but we are presenting these lessons with a view toward promoting development of exam skills. The basic philosophy of the creators of the PTG Tuning Exam is that you should be able to control what you do in the high treble, and since the clean single octave is a fairly objective goal to work for, that is what we will compare your high treble tuning to. If you tune clean double octaves, and do so perfectly (all else being equal), you will probably still pass, but with points off in the top half of the top octave. But why take a chance? Learn the proper way to tune the top octave for the exam, and you will have enhanced your skill to better control tuning the top octave as you like it.

If you have been following these PACE lessons, many of the tests we use here should be familiar. However, some further explanation of their application to the high treble is appropriate. It is especially important to tune octaves here playing both notes together. Played in sequence, your ear will probably want you to tune the upper note sharper than advisable for the exam.

Understanding and using the single octave resonance test effectively guarantees you an excellent single octave tuning. Try it. If you have access to a Sanderson Accu-Tuner or other measuring device, use it as an ear trainer for this test. Set the SAT for the second partial of an octave 6 note, then tune the octave above to that setting while silently depressing the octave 6 note, paying particular attention to how the sound changes due to resonance as you approach the single octave setting from above or below. Now try it without the machine, and see if you can find that same resonance pitch.

You perform the M10-M17 test for 2:1 single octaves the same way in the high treble as elsewhere (see PACE lesson #7), but the interval beats are quite fast, false beats interfere more, and the tuning pin is ultra-sensitive. For practice purposes, raise the pitch of the test note enough to give you test interval beat rates you like that are still on the wide side. The M17 should always beat a little faster than the M10, and never slower.

Parallel M17s behave rather strangely in a single octave high treble tuning. To be sure, you should find consistency in the parallel M17 beat rates, and sudden jumps will still indicate a problem. However, instead of the uniform acceleration we find everywhere else on the piano, in the high treble tuned as single octaves, parallel M17s may become equal-beating, or even begin to decelerate toward the top. This is a rather subtle effect, and mostly of academic interest, since the beat rates are rapid and especially difficult to focus on amid more prominent false beats in this area. But as Rick Baldassin and others have pointed out, if smoothly progressing M17s all the way to the top are important to you, then you should be tuning double octaves, not single octaves.

The M3-M17 double octave test, and the M6-M17 twelfth test will usually show narrow intervals in octave 7, the twelfth becoming narrow sooner than the double octave. In this type of tuning, by the time you get to octave 7, all twelfths will be decidedly narrow (M6>M17) and double octaves will be either pure or slightly narrow, (M3≥M17) with both intervals getting narrower the higher you play them. If these relationships are reversed (wide double octaves and/or twelfths), your note is very likely sharp with respect to a clean single octave. Adjacent parallel double octaves and twelfths should be similar, whatever their width, and thus relationships among their test intervals will also be similar. Differences indicate possible problems. Review PACE lesson #18 for more on parallel interval tests, and lesson #22 for more on double octave and twelfth tests.

As an example of Kent Swafford's "chord of nature" arpeggio test, a.k.a. "the 6-5-4-3-2-1 test" (after the number of the partials of test notes coincident on the note you're tuning), play the minor chord A4-C5-E5-A5 with the left hand, followed by E6 and E7 with your right. If E7 sounds good, it is good. This is a nice test to finish your tuning with, starting with F3 under your left pinky and C6 under your right, and rolling on up to the top with parallel chord of nature arpeggios. It will bring out the quality of your tuning, as well as reveal discrepancies. It is also an ingenious cross between a musical test and a beat-rate check, perhaps providing the alchemy that may help you create the illusion of a perfect high treble tuning.

The last two tests we will discuss here are the major scale ascending tetra chord test and the P12-P19 comparison test. Both can be useful if you get lost and want to find out if you're even in the ballpark. Both are mentioned in the Tuning Exam Manual, and are sometimes useful for demonstrating gross errors in the high treble. The tetra chord do-re-mi-fa should sound musically "correct." Here we are making a rather crude judgment of note spacing, which we all find necessary at times. If the "fa" (for example, F7 in the series, C7, D7, E7, F7) sounds too close to the "mi" you're flat, and if it's too widely separated (closer to a "so", or G7 in the example), you're sharp. The P12-P19 test is most useful for indicating sharpness; if the P19 (double octave-fifth) sounds cleaner than the P12 (octave-fifth) then you are way too sharp for a single octave tuning.

In conclusion, the top octave is an area which presents unique challenges; sometimes difficult to hear, almost always difficult to control. Practicing the tests and techniques of this lesson should help you hone your high treble skills and learn how to listen to and control your tuning in this area.

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

TECHNO*stuff*

Richard Anderson, RPT • Chicago Chapter

R.I.P. Part II

Condemning a piano is one of the most valuable services we perform for our customers and society. There must be millions of pianos pushed into some forgotten corner, or buried under piles of stuff that really ought to be buried six feet under. Most TV sets are sent to the landfill well before they reach the condition of some pianos still in use in some living rooms. Most cars are traded or sent to the salvage yard when they become unserviceable. And we all know what happens to horses that reach the condition of many of the pianos for which people still pay money.

We are in this profession because we believe that the world is a better place because of the positive effect of music and pianos on the human race. We must also realize that the presence of rotting hulks of pianos dotting the landscape has an effect on people that's contradictory to the concept that a piano is a fine musical instrument that needs regular care. Condemning a piano is an important part of our professional repertoire, and a natural step in the life of the piano. Providing condemnation service is as important as, and logically leads to, consulting on the purchase of another instrument. Each condemnation proceeding is an opportunity to reinforce the notion of the piano as a musical instrument instead of consumer commodity, and gives us the opportunity to create people who are happy with pianos, which is our ultimate professional goal.

Condemning a piano is simply assisting the customer in reaching the decision that the instrument is not in a condition that meets their needs, and cannot be put in a condition that meets their needs based on technical and/or financial considerations. This decision must be reached by the customer, and is unique for each combination of customer and piano. It is important to decide that a piano is inappropriate for a given situation, rather than decide that it is of no use to anyone.

Guidelines for condemning a piano:

- You must pay your respects in person. Don't condemn a piano over the phone. This is a service that requires professional evaluation, judgment and compensation. The time for a phone consultation was before they bought the thing.
- Evaluate the customer first. What are their piano needs? Get the who, what, where, when, why, and how they ended up with this piano.
- Evaluate the piano thoroughly. Don't overlook things like brass flange rails in case they decide to spend some money on it.
- Separate the piano from the people in your mind and in your communication with the customer. They will be defensive about their purchase or how they've maintained the instrument. Make sure you don't offend them by what you say about their piano. Also separate the piano from its present condition. Good things can be in bad shape and vice versa. Nobody's piano is immune from the laws of physics and the ravages of time. Parts break and wear out. There's no need to apologize for it and no reason to assume it wouldn't happen to this piano.
- Present your evaluation factually and positively. Say, "The cost of repair will exceed the finished value of the instrument," rather than, "I think this thing is landfill material." Be specific enough to make your point, but don't get in over your head. If they inquire how much say, "Thousands." If they say "How many thousands?" refer them to a rebuilder.
- Assist them in deciding that this is, or isn't, the piano for them, but let *them* condemn the piano. Give them positive reinforcement for wanting a piano for their family and encourage them to keep looking.

Next month we'll decide how to respond when they ask, "So now what do we do with this thing?"

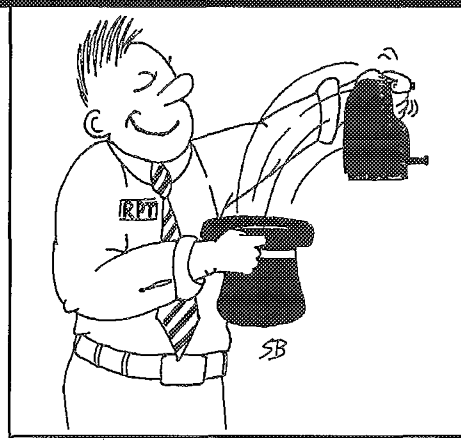
Grand Illusions . . . The Page for *Serious* Cases

MEMO
DATE: May 30, 1995
TO: Steve Eggleston,
Director, IWU Civic Orchestra

FROM: Barbara Richmond
Piano Technician

SUBJECT: Faculty Showcase series

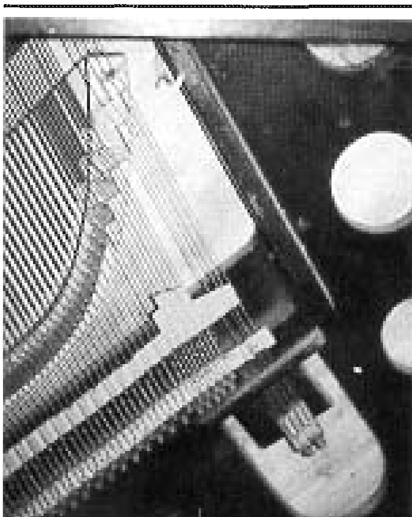
I was very happy to see the memo about the new Faculty Showcase series featuring faculty performances with the Wesleyan Civic Orchestra. I hope you will consider David Vayo's newly completed "Concerto for Piano Tuner and Orchestra (The Ping Ping)," commissioned by me. It will truly be a unique experience for the audience since they will be able to see what normally goes on before the concert and, perhaps, the piano tuner will finally be appreciated. Also, this is my chance to have a captive audience since most people start running away when I start to tune. The piece is certainly on the forefront of the contemporary music scene, and is only slightly more repetitive than Ravel's "Bolero." I am sure it will be received as well as the premiere of Stravinsky's "Rite of Spring." The piece is written in the traditional concerto style of three movements. The first movement (Serioso pain-issimo e glissandi) starts 20 cents below pitch, but by the end has raised to A-440. Just imagine the clarinet starting of Gershwin's "Rhapsody in Blue" over and over again. Then, as the piece progresses, every note of the keyboard is featured, chromatically modulating 88 times. For dramatic effects, the percussion section of the orchestra adds some terrifically loud rim shots to represent strings breaking. This movement is undoubtedly the one filled with the most angst and might bring some listeners, if not to tears, then at least to the edge of their seats.

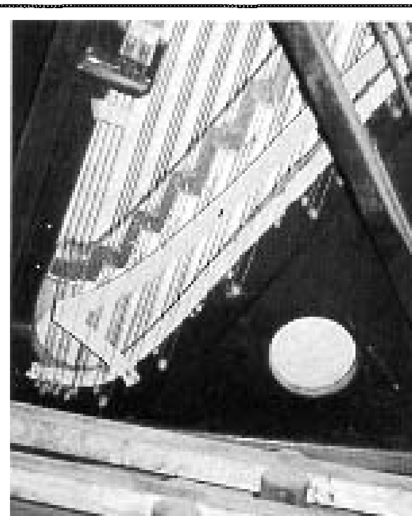


The second movement (Scherzo repitito interrupti) is light-hearted, since most of the hard work was completed in the first movement. During this movement, intervals of fourths and fifths and thirds and sixths of the temperament provide the motif. It is heard repeatedly as the octaves progress to the far ends of the keyboard. There are a few solo spots for some non-traditional instrumentalists (this is contemporary music, after all) — a vacuum cleaner player, someone good with a lawn mower and, lastly, a person with tremendous breath capacity to blow wind chimes. A grand pause occurs in the music after each of these instrumentalists performs and the piano tuner walks across the stage and asks them to stop. It is by far the most lyrical of the movements.

Finally, the third movement (rondo noioso senza coda) moves along quickly for the most part. It does occasionally get stuck on a note here and there as the unisons are tuned. There is wonderful use of syncopated accents as the strings are rendered. The subtleties in this movement will not be heard by everyone. Indeed, some may think of this as the musical version of Chinese water torture, so they will really be glad when it has ended. You can count on thunderous applause noise as the piece ends, as the audience jumps to its feet (and exits). You may want to put this piece at the end of the program.

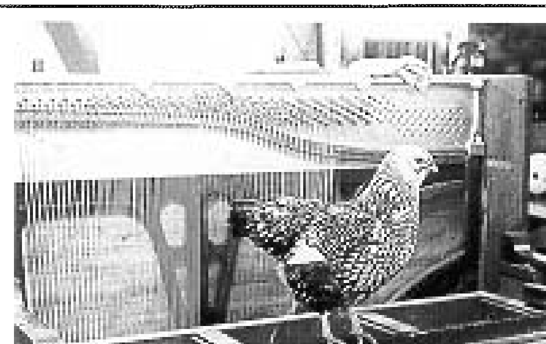
Thank you for considering this outstanding composition.





The Answer!

An attempt to solve the "break" problem between tenor and bass. Piano is a circa 1890 Conover upright — Submitted by Ed Pettengill, RPT



Don't be Chicken. Fix that Birdcage!

— Submitted by Les Conover, RPT

PTGReview

PIANO TECHNICIANS GUILD

Dedicated To PTG News • Interests & Organizational Activities

In Passing . . . Dennis Nicholson

The piano industry has lost one of its brightest and best with the passing on May 3rd of Dennis Nicholson. Dennis was many things to me ... mentor, colleague, friend, and I shall miss him terribly.

Life was not always easy in my 12 years at the American Institute of Piano Technology, but always worthwhile. Those of us who studied with Dennis learned piano technology along with business skills, personal triumphs (and failures), and "alternative learning experiences." He encouraged us to do everything, as long as neither we nor pianos were irreparably harmed, thereby setting us free to soar as far as the imagination could allow.

Dennis' vast experiences befit a man of 90, but his playfulness was that of a 9-year-old. His long and colorful history in the Piano Technicians Guild culminated in his program for the South Bay Chapter in April 1995, where he shared with us his love for pianos, and for mankind, whether colleagues or clients. We appreciated his rare gift of seeing through the ordinary to the sublime.

At the Memorial Service on May 18th, many of us gathered to swap stories and to comfort each other, as well as to explore the man and the enigma who had woven himself so closely into our hearts at the same time he drove our minds crazy. Our immediate reaction is one of great loss, until we remember the multitude of things that he would have us do in life and in love. We are his legacy, and I for one will do everything in my power to live up to that.

— Diane B. Cottrell

St. Louis Seminar a Testing Success

The Central West Regional held in St. Louis May 4-7 was not only a huge technical and social success, it turned out to be one of the most significant weekends for 10 members of the PTG. During the weekend, not only did 11 members take exams, out of which 10 of them passed, we had 3 members upgrade to RPT, and one RPT qualify for Certified Tuning Examiner.

Rick Thompson, of the Kansas City Chapter, Rod Butterworth, of the Ozark Chapter, and Mike Dugan, also of the Ozark Chapter, passed the Written Exam. A big thanks to Ken Ponche for administering the written exam.

Steve Oman of the South Dakota Chapter and Wendy Parham of the Washington D.C. Chapter passed the technical exam. By passing the technical exam, Wendy was able to upgrade to RPT. A big thanks to Mike Drost, Dave Durben, Randy Potter and Larry Caldwell for helping administer the technical exam.

Steve Oman of the South Dakota Chapter and Charles Terr of the Chicago Chapter passed their tuning exam, and by passing, upgraded to RPT. Ronald Johnson, of the Chicago Chapter and Thomas Malone of the Memphis Chapter also passed their tuning exams.

And finally, Scott Rogers of the South Dakota Chapter passed the tuning exam to become a CTE candidate. A heartfelt thanks to Scott for accepting the responsibility.

A big thanks to John Baird, RPT, CTE, of the Central Illinois Chapter for helping administer the tuning exam, and Ken Ponche, Scott Rogers, Brian DeTar, Jim Grebe, Ben Accardi, Leroy Fritz, Matthew Deffley and Kent Swafford for helping with the tuning exams.

Again, congratulations to all who passed, and a special congratulations to those who upgraded to RPT.

— Willem Blees, RPT, CTE
St. Louis Chapter

Passages

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 the 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.

August 14
NORTHERN CALIFORNIA
AREA EXAM BOARD
Tuning & Technical Exams
Location: Skyline College
Contact: Russell Brown
408-429-5453

September 30
POMONA VALLEY ANNUAL
SEMINAR
Location: Unknown at this time
Contact: John Voss
2616 Mill Creek Rd.
Mentone, CA 92359
909-794-1559

October 5 - 8
NEW YORK STATE—
NYSCON
Howard Johnson Plaza Hotel
Oakville, ON CANADA
Contact: John Lillico
605-200 Queen Mary Drive
Oakville, ON L6K 3L1
800-469-7266

October 12-16
TEXAS STATE
ASSOCIATION SEMINAR
Clarion Hotel
Richardson, Texas
Contact: Thom Tomko
114 S. Greenstone Lane
Duncanville, TX 75116
214-780-0143

October 21
SAN DIEGO SEMINAR
Marina Village Conference Center
Mission Bay
San Diego, CA
Contact: Dan Litwin
2701 Elyssee Street
San Diego, CA 92123
619-565-7742

October 19-22
CENTRAL EAST
REGIONAL SEMINAR
Mariott Hotel
Milwaukee, WI
Contact: Dave Hulbert
4760 N. 158th St.
Brookfield, WI 53005
414-781-6343

November 3-5
NORTH CAROLINA
REGIONAL CONFERENCE
Omni Hotel
Durham, NC
Contact: Richard Ruggero
3504 Fairhill Drive
Raliegh, NC 27612
910-787-7123

Associates Earn RPT Ratings In June

REGION 2

201 WASHINGTON, DC

RODNEY E. BUTLER
6207 EDWARD DRIVE
CLINTON, MD 20735

WENDY R. PARHAM
9316 SPRINGHOUSE LANE, #J
LAUREL, MD 20708

REGION 4

452 CINCINNATI, OH

MATTHEW L. SHOEMAKER
1320 POGUE FRAZEE ROAD
CAMDEN, OH 45311

462 INDIANAPOLIS, IN

LISA C. LONDE
1118 WESTFIELD CT., W., APT. E
INDIANAPOLIS, IN 46220

REGION 6

917 POMONA VALLEY, CA

CARL M. ROWE
1124 N. SAN GABRIEL AVENUE
AZUSA, CA 91702

956 SACRAMENTO VALLEY, CA

BROOKS WEISMAN
1141 LAUREL STREET
NAPA, CA 94559

REGION 7

981 SEATTLE, WA

DAVID G. COWAN
1540 GRANT
BELLINGHAM, WA 98225

In Memory

VAUGHAN HARRIS, RPT
LAS VEGAS, NV

New Members In June

REGION 1

029 RHODE ISLAND

JOHN C. HIGBY
30 CYDOT DRIVE
N. KINGSTOWN, RI 02852

064 CONNECTICUT

EVAN C. DUNNELL
64 RACHELLE AVENUE
STAMFORD, CT 06905

122 CAPITOL AREA, NY

ZACHARY BARON
32 PLOCHMANN LANE
WOODSTOCK, NY 12498

186 POCONO NORTHEAST, PA

ROGER C. HAYDEN
314 LANSDOWNE AVENUE
CLARKS SUMMIT, PA 18411

LARRY P. TRISCHETTA
1522 LAFAYETTE ST.
SCRANTON, PA 18504

190 SOUTHEASTERN PENNSYLVANIA

TODD A. TREPICCIONE
22 WOOD AVENUE, APT. L
ISELIN, NJ 08830

REGION 2

223 NORTHERN VIRGINIA

CHARLES W. MURRAY
8521 CHAPEL DRIVE
ANNANDALE, VA 22003

274 CENTRAL NORTH CAROLINA

ROBERT G. DAVIS
2808 BRECKENRIDGE CT.
HIGH POINT, NC 27265

327 CENTRAL FLORIDA

ROBIN K. ROGERS
1324 ORANGE STREET
APOPKA, FL 32703

334 PALM BEACH, FL

CHARLES H. CHRISTUS
1970 SE SALERNO ROAD
STUART, FL 34997

REGION 3

701 NEW ORLEANS, LA

JOHNNY A. LOPEZ
525 SENA DRIVE
METAIRIE, LA 70005

771 HOUSTON, TX

ALICE A. SCHMIDT
RT. 1, BOX 59A
E. BERNARD, TX 77435

REGION 4

405 BLUEGRASS, KY

CLAIR DAVIES
848 ARROWHEAD DRIVE
LEXINGTON, KY 40503

PAUL E. DEMPSEY
P. O. BOX 2804
HUNTINGTON, WV 25727

462 INDIANAPOLIS, IN

DOUGLAS K. DALE
2019 N. ALABAMA ST.
INDIANAPOLIS, IN 46202

489 LANSING, MI

KATHLEEN A. BUSHONG
2100 N. SANDSTONE RD.
JACKSON, MI 49201

537 MADISON, WI

LLOYD SCHULTZ
624 COLE STREET
P. O. BOX 126
WATERTOWN, WI 53094

REGION 5

303 BOULDER, CO

ROY L. MCFADDEN
208 W. 52ND STREET
LOVELAND, CO 80538

REGION 6

851 PHOENIX, AZ

MICHAEL A. ALOSI
4419 E. CALLE ALLEGRE
PHOENIX, AZ 85018

BECKY M. GRAVES
1330 W. BROADWAY, #F311
TEMPE, AZ 85282

895 RENO, NV

JOHN F. MCGUIRE
1133 LASSEN VIEW DR.
LAKE ALMANOR, CA 96137

926 ORANGE COUNTY, CA

GORDON F. HUNSAKER
29420 DORSEY STREET
SUN CITY, CA 92586

BUD WINN
225 MALVERN AVENUE
FULLERTON, CA 92632

941 SAN FRANCISCO, CA

JOY K. FRITZ
263 JACQUELINE DRIVE
SANTA ROSA, CA 95405

DANIEL P. GROBANI
MAIL STOP 9103
P. O. BOX 424661
SAN FRANCISCO, CA 94142

945 GOLDEN GATE, CA

MARY J. MACKIE
4001 W. LAKESHORE DR.
SAN RAMON, CA 94583

REGION 7

001 CALGARY, AB

TOM P. THIEVIN
88 GREIG DRIVE
RED DEER, AB T4P 2Y1
CANADA

594 MONTANA

CAROL J. STATON
168 JARDINE ROAD
GARDINER, MT 59030

972 PORTLAND, OR

MARK A. THOMPSON
660 NW GLENEAGLE DR. #44
SHERWOOD, OR 97140

992 INLAND NORTHWEST, WA

DANIEL S. SONNABEND
N. 24211 WESTLAKE DRIVE
9-MILE FALLS, WA 99026

AUXILIARY
E X C H A N G E

Dedicated To Auxiliary News and Interests

President's Message

Here it is, right after completion of the annual PTG convention in Albuquerque. I went, and I am sure I had a terrific time, but I have no idea what really happened. Why? ... because I am writing this in early July. In order to get this *Journal* published, articles must be submitted approximately six to eight weeks ahead of time. So I wish that I could tell you exactly what happened. If this were a perfect world, this is what happened:

After a terrific continental breakfast, we all met for the opening ceremonies. We discovered that we had visitors from all points of the world at our convention. We discussed what was going to transpire during our time at the convention, and got to know each other much better.

Our first Council session opened, where we discussed the various issues of the year, on a national basis. This was a very cordial time where everybody cooperated. We got a significant amount of work done in a very short time. We broke for an international luncheon, where PTG President Leon Spier was our keynote speaker. He spoke about how our two organizations will work closer together for our mutual benefit, in a new spirit of cooperation and friendship.

Hans Sanders donated his time to serenade us with his fantastic piano playing, accompanied by his electronics. It was an absolute delight.

Later in the afternoon, we had a piano recital by the two winners of this year's scholarship competition. After listening to their perfect performances, we shared tea, coffee and cookies together.

In the afternoon we met again for the second Council session. This gave all the Council members time to discuss the issues between themselves and among their constituents, so they knew the proper way to vote in the afternoon. The elections took place, where all the current Board members, with the exception of Vice President Debbie Johnson were re-elected. Debbie asked not to run again this year because of a conflict in personal schedules. In her place, Carolyn Sanders was elected vice president. Welcome aboard, Carolyn!

The Council also voted to raise our dues to $15 to account for the cost of living increases over the many years that the dues were never raised.

We also adopted a new policy that the immediate past president would serve only one year, and his or her duties would be to assist the new president in the transfer of information. They are also to answer any and all questions that the new president may have to assure a smooth transition between presidents. This will become effective after next year's election.

That evening we attended the PTG parties with Baldwin and listened to our scholarship players entertain the entire PTG convention.

Friday we went on our tour to Santa Fe. We stopped in a little artist colony called Madrid on the way. A number of us found good buys, and we all enjoyed the vistas along the way. After a short walking tour through Santa Fe, we had a beautiful luncheon. Mariachis serenaded us as we did our best to devour the fajita buffet.

The rest of the day we were free to roam through the city and shop 'til we dropped. And we did. We had refreshments on the busses on the way back, returning in time for the Yamaha party that evening. The Yamaha party was superb, as always.

Saturday, we had a formal installation breakfast. The rest of the day were were free to either attend a number of selected classes taught exclusively for the Auxiliary members, or to explore Albuquerque on our own. Some of us went on hot air balloon rides, some of us went up the 10,000-foot tram ride, others went to the plaza and museums in downtown Albuquerque. All of us had a great day.

We also made new friendships with the international piano technicians and their spouses that were attending the IAPBT Convention immediately following the PTG Convention. Some of us stayed for the dinner on Sunday evening, and the banquet Monday evening, renewing old friendships and making new ones. It will be fun writing to our new friends from around the world in the months ahead. We all had a safe and comfortable trip home.

Our Scholarship Store sales in the Exhibit Hall was a total success, with sales far exceeding our wildest expectations.

Next month I'll tell you what really happened. We'll see how accurate the story is.

— L. Paul Cook

CLASSIFIEDS

Classified Advertising rates are 35 cents per word with a $7.50 minimum. Full payment must accompany each insertion request.

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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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THE 1995 NORTH CAROLINA REGIONAL CONFERENCE will be Nov. 2-5 in Durham, NC. This year the instructors include Nick Gravagne, Bill Garlick, Wally Brooks, Laroy Edwards, Scott Jones, Ray Chandler, Don Mannino, Kent Webb, John Hartman, David Stanwood, Webb Phillips, Dr. Al Sanderson, Bob Mair, Gina Carter, Gerry Cousins, Ed Dryburgh and others. For more information call Richard Ruggero 919-787-7123 or send a FAX with your address to 919-571-1531 and you will receive our newsletter.

VIDEOS

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JAY-MART WHOLESALERS — !!!Free phone appraisal!!! Buying all types of usable pianos. Cash or bank check on pick up. Won't hesitate on price. Call us first for fast professional service. "Steinway, Mason-Hamlin command specialty prices." Jay-Mart Wholesale, P.O. Box 21148, Cleveland, OH 44121. Call Irv Jacoby collect 216-382-7600

ANTIQUE GRAND PIANOS WANTED: Any restorable condition. Top prices for pre-1850, wood-frame grands in original condition. Ed Swenson; P.O. Box 634; Trumansburg, NY 14886; 607-387-6650; Fax: 607-387-3905.

WANTED: TINY PIANOS such as the Wurlitzer Student Butterfly or other small types. Call collect: Doug Taylor, 607-895-6278. I'll pay shipping!

STEINWAY & MASON HAMLIN WANTED!! "Dead or alive." $$$ Grands, uprights, consoles—any size, cabinet style or quantity. Cash and immediate removal. Finders fee for successful purchases. Call us first!! 800-438-3814 toll free or write to be listed in our worldwide data banks. Piano Wholesalers, 5817 Wickfield Drive, Parma Heights, OH 44130. Call us first!! 800-438-3814.

DISPLAY AD INDEX

Piano Discussions™

August 1995

News From The World of PianoDisc

Gary and Kirk Burgett (second from right and far right) join representatives from the Panattoni Development Company for a ground breaking ceremony at the site of Music System Research's new 100,000 square foot facility.

PianoDisc Installation Training 1995

- Aug. 8-12
- Sept. 12-16
- Oct. 17-21
- Nov./Dec. 28-2

Continuing Education Series 1995

- August 3-4
- October 12-13

Tuition for the installation and Continuing Education seminars is **free**, but a $50.00 refundable deposit is required for confirmation. The PianoDisc Continuing Education Series seminars are restricted to PianoDisc certified technicians in good standing. For more information about attending a PianoDisc installation Training seminar or a Continuing Education seminar, call PianoDisc during our office hours (see below).

PianoDisc

4111 North Freeway Blvd.
Sacramento, CA 95834
Phone: (916) 567-9999
Fax: (916) 567-1941

Tech Support: (619) 258-1460 (916) 567-9999

Our telephone lines are open daily (except weekends and holidays) from 8 AM-5 PM Pacific Time.

Ground broken for new MSR factory

In 1993, PianoDisc moved into new quarters that more than tripled the space we had at our original location. The new building was so vast that it seemed as though it would never be filled, and could accommodate all of our probable growth for years to come. Now, less than two years later, the proverbial seams are bursting. A combination of increased demand for PianoDisc and several new products to be manufactured has led to one conclusion: it's time to move again!

Earlier this month, owners Kirk and Gary Burgett participated in a ground-breaking ceremony for their new 100,000 square foot plus factory in Sacramento. The new site, within blocks of the present building, will house all departments of the company, including production areas for PianoDisc, QuietTime, PianoCD and Impact Speakers. Plans for the new building also include a state-of-the-art recording studio for the ever expanding PianoDisc Music Library Artist Series and a well appointed classroom for our installation training seminars.

Actual construction will begin in the fall of 1995, with move-in anticipated for early 1996.

Liner Notes

Classical music greats join Artist Series line-up

The PianoDisc Music Library Artist Series is delighted to announce the recent signing of many of the finest classical artists performing today.

This group of world class pianists includes the extraordinarily gifted **Ruth Laredo**, who will record in September. Following closely in mid-October will be the great **Grant Johannesen.** Shortly thereafter we will host the incomparable **Andre-Michel Schub.** And within days of that session we will be honored to record the very talented **Lorin Hollander.**

The purpose of the Artist Series is to provide PianoDisc owners with performances by some of the finest pianists in every musical category. Our commitment has never been more evident than in the selection of these truly wonderful performers. Look for their disks in spring and summer of 1996.

5-year warranty goes commercial

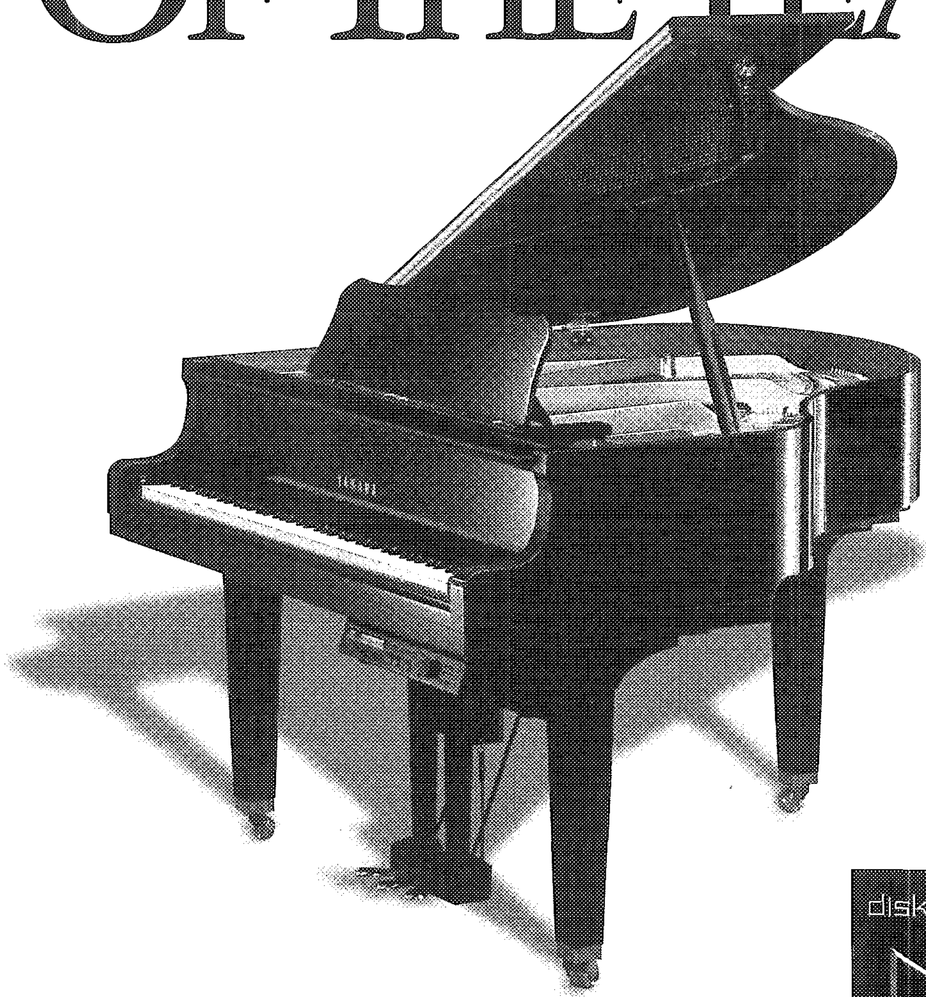
The outstanding warranty provided with the PianoDisc line of products has been extended to include commercial usage. All PianoDisc pianos and retrofit kits sold to commercial establishments will carry the same 5-year warranty previously reserved for consumer purchasers only.

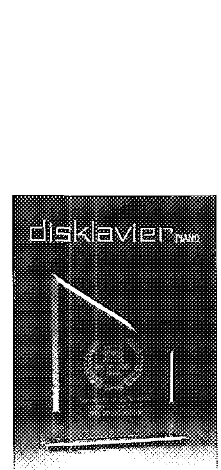
The warranty covers any defective parts for a period of five years from date of purchase.

"PianoDisc has a warranty second to none in the industry," says Vice President Tom Lagomarsino. "Our warranty no longer makes any reference to the way in which the system will be used. All purchasers will be equally covered."

Now the world's best selling player system, with the most advanced technology, has an outstanding warranty available to everyone.

1994 Keyboard Product Of The Year





Dealers have chosen the Yamaha Disklavier Piano as "Keyboard Product of the Year." It just goes to show that great craftsmanship, great technology, great dealers and great salespeople can make things happen.

YAMAHA®