PIANO TECHNICIANS

Journal

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August 1996

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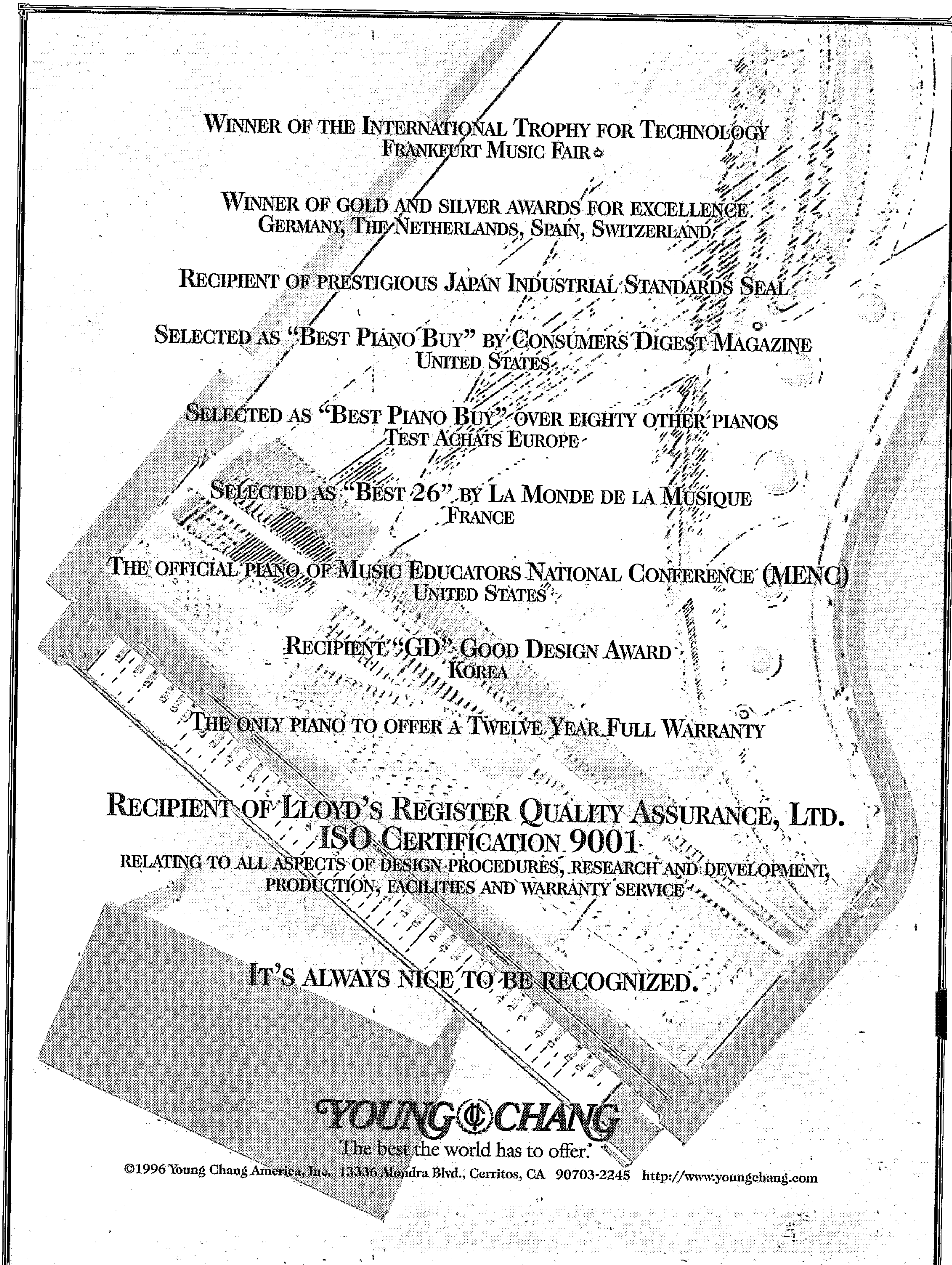
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PIANO TECHNICIANS
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Editorial Perspective

The Road to Mastery

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

Recently, I attended my son's portfolio show, an event marking his completion of a two-year college program in graphic design and illustration. During the show, it became obvious that he was on "cloud nine" over his graduation. He exclaimed at one point, with considerable gusto, "I'm not a student anymore, baby. I'm a working professional now!"

On hearing this, my mind went back to those heady days when I was working in my first job as a piano technician, following my two years of training. What exciting times those were! The sky was the limit, baby. I remember imagining that, because I had had the advantage of good training in an established program (an opportunity not enjoyed by most of my peers), I was somehow among the elite in my chosen field. I cringe now as I contemplate my youthful hubris.

My dentist remarked recently that a dentist emerges from dental school as a technician. The same dentist, he said, becomes an artist after years of practice. Similarly, although I had passed the PTG exams (such as they were in 1973), I had yet to learn the art of really solid tuning. I had yet to learn the art of tuning a truly beautiful unison. I had yet to learn the arts of fine regulating and voicing. Only through humiliating real-life lessons do we gain sufficient motivation to go "back to the drawing board" in re-evaluating our skills and honing them to a sharper edge.

I told my son, "The day you stop being a student, you'd better just pack it in, because you'll be finished." Although he is talented and performed well in his training, he has yet to master perspective in all its forms. He has yet to master the subtleties of design and color, the nuances of light and shade that will make him, one day, a true artist.

And how do we know when we've achieved that elusive quality — mastery of our craft? I suspect we're on the right path when we come to the realization that there's always more to learn, that mastery is a mirage, moving ever farther away—just as we begin to think we can distinguish its features. The letters "RPT" signify not mastery of the art of piano technology, only the possession of a few measurable skills. Yes, we should be proud to have those letters after our name, or we should work hard to attain them, because they mean we've put ourselves on the line to show what we can do, they mean we cared enough to do things the right way and qualify by the only uniform standard available. But in each craftsperson, at whatever level, should glow the unquenchable desire to move towards artistry. That's where the road begins.

■ ■ ■

This issue signals the end of Bill Spurlock's fine PACE series on grand action regulation. By the time this issue appears, Bill will be well into a much-deserved rest, and the articles will have been bound into another PACE book, available from the Home Office.

Please submit tuning and technical articles, queries, tips, etc., to me:
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FEATURES

COVER ART

This month's cover shows a Mylar® pattern and a damaged bass bridge. See RPT Don Valley's article on making a new bass bridge beginning on Page 39.

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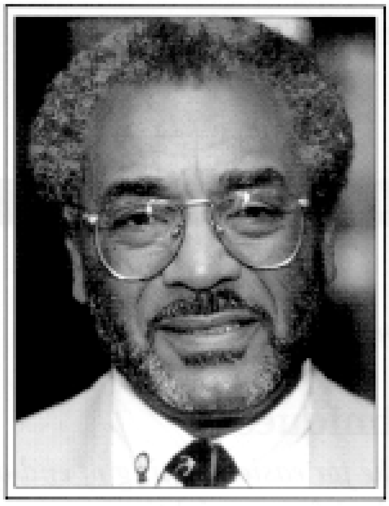
Reflecting On Dearborn



PTG President
Marshall B. Hawkins, RPT

The convention is over, but the benefits gained will live on and on. What I hear from all with whom I have talked, along with my own observation, is that the 1996 Convention and Institute was nothing less than exceptional. Institute Director Paul Olsen and his team did one fantastic job in putting together and carrying off this year's Institute.

All who attended will be forever grateful. The instructors, Home Office staff, host chapter personnel, manufacturers and exhibitor cooperation, plus input from many varied sources all aided the superb direction received from our President and Board of Directors.

It is always a pleasure to see those who traveled great distances to be able to interact with us as a group. This year we had participation from a number of countries. Attendees from Norway, Greece, France, Brazil and Australia along with our membership and friends from our border neighbors Canada and Mexico made for an excellent mix. When we add in Puerto Rico and the Virgin Islands, one can easily see that this all contributes greatly to the warmth of togetherness we experienced.

Allow me to publicly thank Steinway and Sons, pianist Ralph Votapek, conductor Dia Uk Lee and the Michigan Chamber Players for their outstanding performance and involvement at our annual Golden Hammer Awards Banquet. Having always had solo piano as the primary focus, the added enjoyment this year with the chamber players was really spectacular.

Needless to say we missed seeing those not present, but most of all those not with us missed out on the vast amount of learning available and the sharing that takes place between classes and after hours.

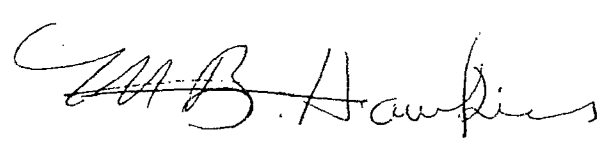
Pausing for a moment to reflect back over the 38 conventions before this one allows us the opportunity to appreciate the path of progress our organization has followed. The pause can only be momentary, however, because we must be off to pursue our goals of the future. Now let us continue.

Our focus, in my opinion, should be to benefit from the combined efforts and collective knowledge from our past while we refine the process of our future endeavors. In many ways we are like a sleeping giant. Now, perhaps, we are just beginning to move about as in the morning prior to waking up. Five years worth of the future is really not too much to bite off, and that is what we intend to do. That will take us into the next century, which will be exciting to say the least. I see it as a worthwhile goal and hope you do as well.

I thank the membership, which through the Council, voted to have me serve as your president during this 40th year of our existence.

While we must and will focus on our next five years, the immediate goal is this year, which will culminate at our next convention in Orlando, Florida. Let's begin now to think and plan to be there.

I appreciate your trust and will do my utmost to serve you in a manner in which we all can be proud.



More on Humidity-Related Pitch Changes

Regarding the letter from Fred Sturm in response to my article on the piano soundboard's reaction to changes in humidity: Mr. Sturm's observations regarding the differences in pitch change between adjacent unisons — one using trichord plain steel strings and the other using bichord wrapped strings — are well taken. I should probably have gone into this characteristic of piano strings somewhat since it does have a bearing on how pianos go out of tune. To be honest, I didn't even think about it at the time I was writing the piece.

As may be, the article was primarily intended to address the changes and movements that take place within the soundboard assembly itself that result from the normal fluctuations in the moisture content of the wood soundboard panel that take place throughout the year. And in that context I must point out the following:

1) Yes, piano bridges are certainly stiff. However they are not perfectly stiff. They do indeed flex and bend in response to the pressures exerted on them by the ever-changing soundboard. In other words, we cannot assume that the treble and bass bridges rise and fall by about the same amount along their entire lengths since, in fact, they do not. Nor do they rise and fall uniformly relative to each other.

That piano bridges do not rise and fall uniformly can easily be proven — indeed, has been so — by actual measurement. It takes only some time, some precise measuring equipment, a dedicated piano and an environmental chamber. Simply place the piano into the controlled atmosphere chamber and rig it with a series of dial indicators recording the height of the piano bridges at your various points of interest. Expose the piano to varying levels of temperature and humidity — allowing adequate time for the instrument to stabilize after each change — and carefully observe and record the results. This will give you a bridge elevation map for that design at various humidity and wood moisture content levels. Well, at least you'll have one for that specific piano. Unfortunately, it won't tell you specifically how another piano of another design might react so you'll also have to test that one. And then another. And another. And ... well, you get the idea.

2) The lower end of the tenor bridge and the upper end of the bass bridge are never directly connected. At least they aren't in any "modern" design practice of which I am aware. Hence, what happens to the lower end of the tenor bridge will have little or no influence over what happens to the upper end of the bass bridge, nor will the upper end of the bass bridge appreciably affect the lower end of the tenor bridge.

In some designs — notably the "continuous" bridge design used in the Steinway model B and D pianos and their emulators — the lower end of the tenor bridge is connected to the lower end of the bass bridge. An analysis of this design, however, will show that the forces acting on each bridge will have only a limited influence on the other — at least in this context, any effect it may have acoustically is another matter — through the ranges of movement involved and, again, the vertical movement of the tenor bridge will have virtually no influence on the upper end of the bass bridge.

3) The actual string tensions used in the trichord and/or bichord wrapped strings used at the transition from plain steel trichords to wrapped strings — whether or not this transition takes place at an actual plate scale break — vary wildly from one design to the next. These tensions can be close to the breaking strength of the core wire in one design or they might be approximately similar to the tension of the adjacent plain steel strings in another.

4) Unfortunately, we cannot assume that the movement of the bridges will produce a fairly similar change in tension for each string crossing the bridge. They don't. There are simply too many variables in the scale designs and mechanical designs of various pianos to allow this assumption.

I certainly agree with Fred about the desirability of simple explanations for complex problems. Ah ... could it only be so! Unfortunately, the points Fred raises in his letter are actually additional factors that have to be entered into the overall mix. They don't negate or simplify any of the phenomena I described in my earlier articles. What he has actually done here has been to remind us of yet one more set of variables that needs to be considered before a complete answer to the original question of why and how pianos go out of tune in response to seasonal weather changes can be given. In the process he has actually made any "final" explanation even more complex than it appeared when I put forth my own — admittedly limited — analysis. But thanks, anyway!

—Del Fandrich, RPT
Puget Sound, WA Chapter

And Still More On Why Pianos Go Out of Tune the Way They Do

This letter is in response to a question in the April 1996, *Journal*, "Why do those strings at the bottom of the treble bridge go out of tune the most?" and also to examine why the last two wound unisons on a treble bridge are more stable than their unwound neighbors.

First, I will accept the explanation as to how the bridge moves as stated in the February 1996, article in the *Journal* by Del Fandrich, RPT.

Second, while the entire bridge does not move the exact same amount, I believe that over a relatively short span, say four to six unisons, the movement of the bridge can be thought of as uniform.

Third, Hooke's law applies to piano wire so that a change in the tension of a string produces a corresponding change in length. This means that piano wire behaves like a spring. For example, if a tension of 10 units of force produce a linear increase of 5 units in a wire, then the addition of 10 more units of force will result in another linear increase of 5 units, provided the force does not exceed the wire's elastic limit.

Some facts:

1. The elastic limit of piano wire is about 70 percent of its breaking strength.[1]
2. Size 15 wire has a break strength of about 340 pounds,

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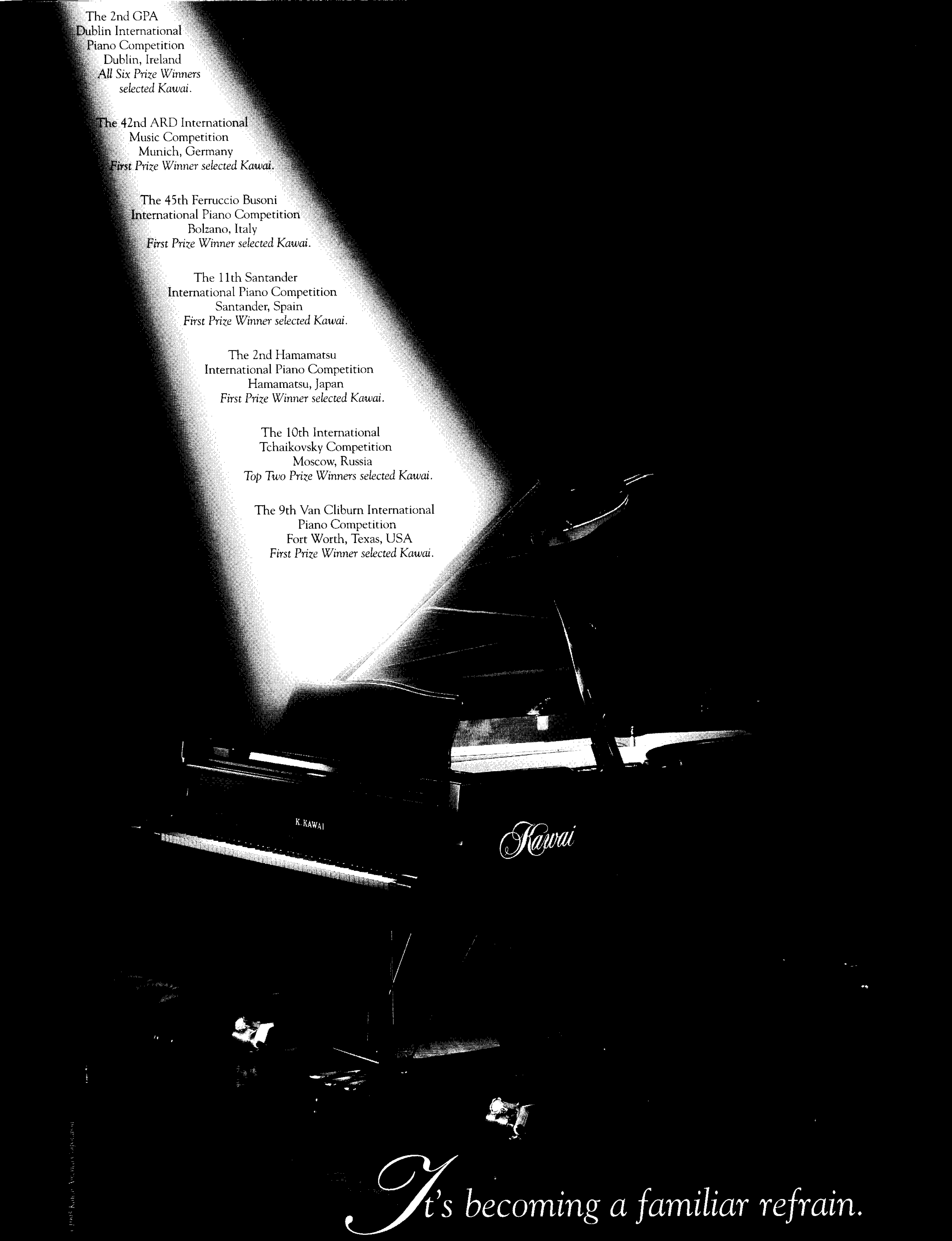

The 2nd GPA
Dublin International
Piano Competition
Dublin, Ireland
All Six Prize Winners selected Kawai.
The 42nd ARD International
Music Competition
Munich, Germany
First Prize Winner selected Kawai.
The 45th Ferruccio Busoni
International Piano Competition
Bolzano, Italy
First Prize Winner selected 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.
K.KAWAI
Kawai
It's becoming a familiar refrain.

TT&T Modified Rubber Mute

Before we tune unisons, most of us mute at least the tenor section with a temperament strip. Sometimes, however, we have a hard time muting the lowest note in the tenor section because the first several notes in this section, which often consist of wound double strings, are even in number. In fact, muting the first or last note in any section can be difficult.

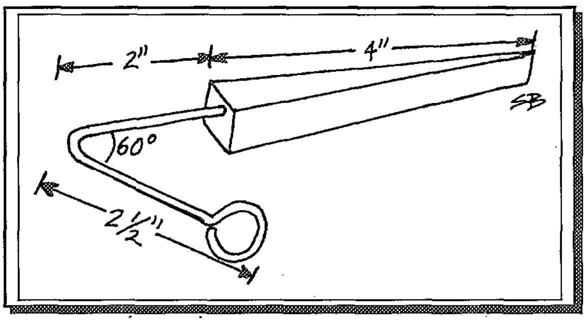
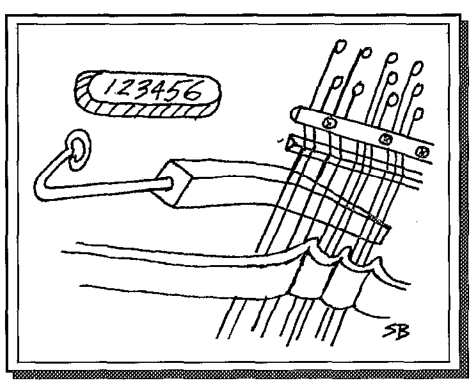


Figure 1 — Modified wedge mute with dimensions show.

I adapted some rubber wedges to enable me to mute these notes very quickly, easily, and in a consistent order. The modified wedge is illustrated in Figures 1 and 2. I just insert the wedge under the outermost string of a section and let the end of the wire handle press against the plate after muting all notes with strip felt. You don't have to figure out which string should be muted and tuned to match the tuned strings. There is always a regularity to the procedure, whether the number of notes is odd or even. You can also use it on the most exterior strings on triple-strung notes, and tune the middle string of the group.

Figure 2 — Modified wedge in use at lower end of tenor section.



This wedge can be used on grands as well as verticals. I deem the effect of a bigger wedge is better than that of a smaller one. Just try the modification and see if you like it. You may gradually come to rely on it in your tuning work.

— *Fengsheng Chen, RPT*
Wichita, KS Chapter

TT&T Re-Weighting a Keyboard

At this writing, I am one of the newest members of the PTG. I joined directly as a result of reading back issues of the *Journal* over the last couple years, and seeing that PTG members actually share hard-won knowledge openly with others. This is extraordinary, and I am happy to be part of such a group.

While re-weighting a keyboard recently (after installing new hammers, shanks and wippens), I realized that I have not seen my procedure for leading keys in these recent *Journals*. In the spirit of sharing, I present it here for you, thanking you all for the trouble you have saved me in the past.

Using Bill Spurlock's fine set of gram weights and his recommendations, I weighed every key's downweight and upweight, and wrote the results in orderly columns. The difference between the two weights is twice the friction in that key. For example, my note #88 had a downweight of 55g, and an upweight of 29 g. The difference, 55 g. - 29 g. = 26 g. is the amount of friction in the down stroke and the up stroke, which means that half this amount, 13 g., is the friction in that key. With this number for the friction, I can now find what I call the true weight of the key, either by adding the friction to the upweight, or subtracting it from the downweight: 42 g. either way. Similar measurements and calculations are then done on all keys, and the results are tabulated. I manage to fit all my data on a 4" x 6" card.

In studying this card, I can, of course, see all the keys that have too high a friction value, and can check the pinning of these hammer and wippen flanges. What interests me here, though (for this article), is the column of true weights. The ideal true weight would be halfway between the recommended down weight of 50 g. and up-weight of 20 g.; that is, 35 g. This ideal true weight also gives the clue that friction should be a maximum of 15 g. for these recommended upweights and downweights to be correct.

Taking the key #88 in my hand, I look at my card and see a true weight of 42 g., and wish that it were 35 g. instead, the ideal true weight. How do I change this? Of course, we know that the best way to lower key weight is to lower the weight of the hammer heads. This discussion assumes that the hammers are already as small as they can rightly be. As you know from the teeter-totter in the school yard, sitting close to the handle can make your side "lighter," while squirming out to the end of the seat makes you "heavier." The place where the gram weights sit on the front of this natural key when the measurements are taken, on this grand, is 10 inches from the balance rail pin. This 10 inches, multiplied by the extra weight I wish to add to the key, 42 g. minus 35 g., or 7 g., gives a value of the increased torque I want in this key: 10 inches x 7 g. = 70" g., that's inch-grams of torque. The 3/8" lead weight that I have weighs 10 grams. To find where in the key it should go to create a torque of 70 inch-grams, I divide this 70 inch-grams by my 10 grams to get an answer of seven inches. In this key #88 there is lots of room for a new lead, and at seven inches from the balance rail hole there is no

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lead there in the way, so that place is marked and labeled "S" for the small lead, and the key is put aside for later drilling with the Forstner bit.

Jumping in thought to the tenor section now, and using the same numbers for simplicity, we find the math more difficult, in that at seven inches from the balance hole we find a lead already in place. However, there is a space available between four inches and six inches from the balance point. If we try a guess of five inches to see what weight we need, we see that five inches divided into 70" g equals 14 g. The half-inch weights I have are 15 grams, so I divide 15 g. into 70" g to get 4.67" from the balance point.

And now, for a final complication, take a sharp from the bass section. Key #2 had a true weight of 42 g. as well, and so was also seven grams too "heavy," but that measurement was taken only 8-1/2" from the balance point (since the sharps are shorter keys). The torque we need here to reach the ideal weight then is 7 g. x 8-1/2" = 59.5" g. In this key, there are two places that are open for new weights, a space on either side of a weight at three inches from the balance point. Two 10 g. weights, placed equidistant from that point at three inches, will give the 20 g. x 3" = 60" g. of torque that was wanted.

As for making the leads stay put, I couldn't make myself pay the suggested retail price of Renner's "Deadleader," even after hearing Clair Davies' excellent advice, "Buy the d— tool!" Instead, I modified a Vise-grip® "C-jaw" tool ($14.99) made for holding stock on a drill press (the tool whose closed jaws make the shape of a square). I ground one jaw surface perfectly flat to press against the wood of the piano key, and left the other jaw about the way it came, to press into the lead and spread it out. It takes about five squeezes to fit the lead into the key, so when you have finished with eighty-eight, you might have the urge to take on your buddies in arm wrestling.

—Jack Bressette-Mills
New Jersey Chapter

TT&T Specialty Clamps

I found a set of three Vise-grip® pliers used to hold parts in place until you can weld them. Now, you may think you're not the welding type, but they can be altered slightly to make them work great on wood! I got a can of that plastic dip and covered the jaws with several coats until I had a good protective pad. Being adjustable for clamping pressure, they can serve to hold a piece of wood in alignment for glue-up, staining, etc. Cost of clamps and plastic dip was under $15.

Also, remember the lowly clothespin. Easily shaped with a knife, sander or file, clothespins make quick, cheap and disposable clamps for tiny parts.

—Bob Bartnick, RPT
[Reprinted from the Richmond Update *newsletter]*

TT&T Another Hammer-Tapering Jig

This is a sequel to my article on tapering hammers in the June, '96 issue of the *Journal*. This idea was introduced to me by Steve Ganz at the Pacific Northwest Conference this

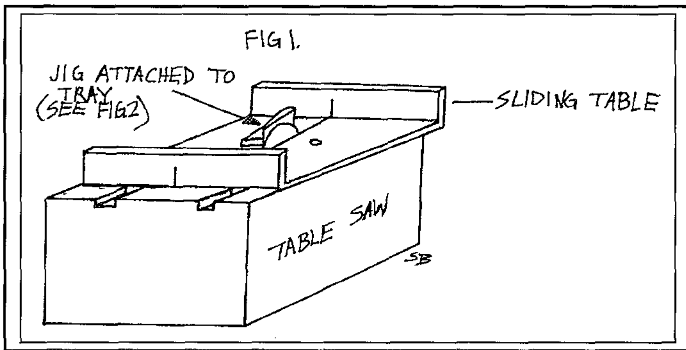

Figure 1

Spring. Instead of using a rotary planer, Steve has a jig that sits over the rip fence on his table saw. I modified the idea by making a sliding cutoff table that has the jig mounted to it (See Figure 1). The advantage of this system is that you are always sliding the jig parallel to the blade.

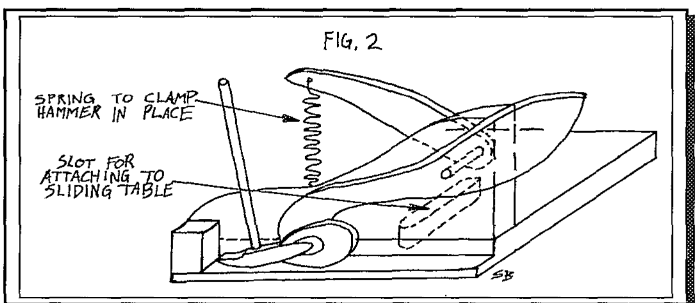

Figure 2

The jig consists of an adjustable structure that looks like a bookend with a clamping device to hold the hammer in

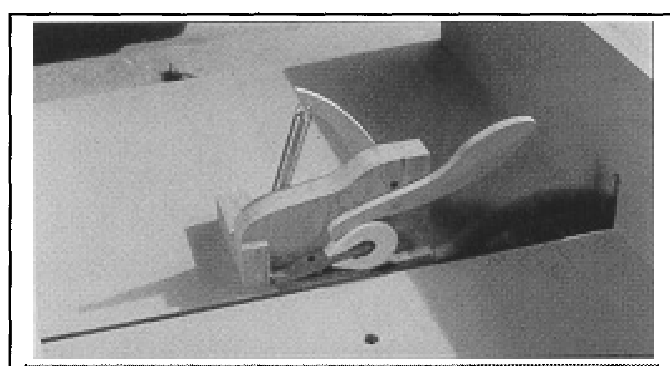

Photo 1

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Tips, Tools & Techniques

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place. There is a spring to provide the clamping force; this is a safety feature. The jig is fastened to a sliding table by a bolt that goes through the table and sits in a slot in the jig so that it can be turned to the appropriate angle and distance from the blade (See Figure 2). Template blocks can be used to get the correct taper for the hammer. Each hammer is run through one time on each side so that an even taper can be achieved on both sides (Photo 1 shows jig in use).

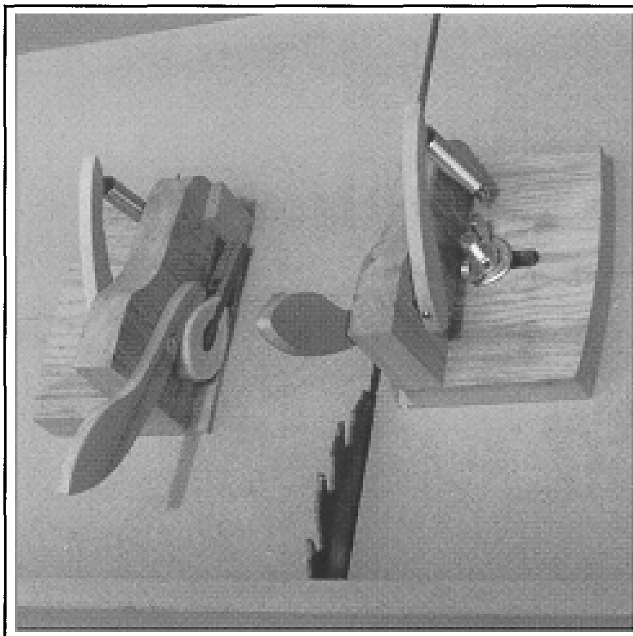

Photo 2

It is possible with this method to taper the hammer on the shank, should this be necessary. However, two jigs are required for this — one to cut from the left hand side of the blade and the other to cut from the right hand side (See Photo 2).

Although this method is relatively safe, please remember to treat machinery with respect at all times.

— Chris Gregg, RPT
Calgary, AB Chapter

Letters

Continued from Page 8

and an elastic limit of about 238 pounds.[2]
3. Size 20 wire has a break strength of about 520 pounds and an elastic limit of about 364 pounds.[3]
4. The tension of the strings at the tenor end of the treble bridge is usually in the 150 pound range, well within the elastic limit of size 15 music wire.

Let us consider the example of a 40-inch upright piano. G3 and G#3 are strung with size 20 wire and F3 and F#3 are strung with size 15 core wire, wound with copper, so that the total mass of each string in the unisons of F3, F#3, G3, and G#3 is about the same. Let us assume that when at pitch, all wires will be at about the same tension. Also let us assume that all four of these notes are tuned 100 cents flat. Then let us raise G3 and G#3 to proper pitch and measure the stretch this increase in tension produces in the wire. Whatever this stretch may be, let us call it 10 units. Next we raise F3 and F#3 to pitch and measure the stretch this increase in tension produces. This stretch can be calculated $340/520 = 10/X$, where X = stretch in size 15 core wire. So, $X = 15.3$ units.

Now we can see that 10 units of stretch in size 20 wire equals 100 cents pitch change while it takes 15.3 units of stretch in size 15 wire to produce 100 cents pitch change.

Let us now go back to the second point in this letter and assume that climatic changes will produce the same bridge movement relative to notes F3, F#3, G3 and G#3. Then we can say that bridge movement will produce the same number of units of change in stretch in all wires on these unisons. So, if bridge movement causes two units of stretch change in the size 20 wire, it will also cause two units of stretch in the size 15 core wire. The pitch change in the size 20 wire will be about 20 cents, while the pitch change in the size 15 core wire will be around 13 cents. The relationship is $10/15.3 = X/20$, and $X=13$.

The above example makes several assumptions which may not hold up to "exact" science, but which will hold up to the very general idea I wish to convey. That idea is that if a large core and a small core wire, about the same length and tension, are both deflected the same amount, the larger core wire will undergo a greater change in tension, and thus pitch, than the smaller core wire.

It is the ever-changing wire sizes along the scale of a piano which are the largest factor in determining the way a piano goes out of tune.

Other factors which would alter the results of the example above could account for a variance in the results of perhaps 5 percent from note to note, with the most significant factor being the difference in pitch change between size 15 and size 20 wire is 35 percent when 20 wire is used as the standard, and 53 percent when 15 wire is used as the standard. So, all other factors become relatively insignificant within the scope of this letter.

1. McFerrin, W.V., *The Piano — Its Acoustics*, Tuners Supply co., 1971, Chapter 10, p. 90.
2. Ibid, p. 178.
3. Ibid.

— Bill Clayton, RPT
Charlotte, NC Chapter

Editor's Note: Contributions in this month's Q&A were taken from the Internet listserv "pianotech."

Q — Action Blues

Friends, I have a technical problem that I am throwing out to the universe in hope of getting some sort of reply. I have a customer who is a valued friend and music teacher. She has a 17-year-old Korean grand about 5'3". I regulated it about four years ago and saw some major improvement in the touch.... But now here are a series of problems that are driving me ***nuts!***

Essentially, the problems come in two categories:

1. Action centers with little or no movement. The friction is unbelievable! I know that repinning and reaming is the solution and I have all the neat reamers for that purpose. I also have the training. My question is :

Will Protek work, or will I have to repin? Or should I replace the darned action parts?

2. This is where it gets tricky. The escapement feels like you're falling off a short but very steep and sharp cliff.. Now that makes a lot of sense doesn't it? You get a lot of resistance and then BAM! (or maybe it's a "thud"...). All measurements are okay, and I mean all. I think it has something to do with how sharp the edges are on the top of the jack and how hard and just plain funky the knuckles are. It's just plain awful to play and I really need some help. Thanks folks!

— *Tom Cobble, RPT*

A — From Tom Seay, RPT

I had much the same problem with a newer, but similar, piano. The way to go is to repin. You shouldn't have to replace anything except the center pins. Protek® is wonderful and works great, except it won't eliminate that much friction. You have to repin. I would also suggest checking the jack pinning as well.

Your escapement and aftertouch should be much better after you remove the friction from the action centers. This all presupposes that the action is in good regulation. If not, make sure it is.

I would also suggest that if the knuckles are hard, take a needle or other thin probe and insert it between the buckskin and underfelt and simply move it from one side of the knuckle to the other. This will slightly stretch the buckskin and make the knuckles less firm. Then use a suede brush and Teflon® powder.

A — From Newton Hunt, RPT

Try the Protek®; it cannot hurt and could help. If the Protek® does not work, repin the whole set of hammer flanges and carefully check the damper pinning as well.

Using a brass suede brush, clean the knuckles then spray them and the wippen tops with SlideAll Teflon® dry lube.

Polish the key pins with Flitz® metal polish and spray them with the above lube, and spray the key bushings also. This will eliminate any friction from the key pins except for key easing which should be done next.

Check the condition of the rocker felt and capstan tops for burrs.

Check and lube wippen centers, all of them.

When repinning, use the Yamaha polished center pins from Schaff.

If you can find a suitable helper to unscrew and screw on the shanks while you do the repinning the job should be done in less than three hours. By doing first odd then even numbers, time spent on hammer spacing is reduced.

If the hammers are worn, then replace the set of shanks and hammers. Yamaha "C" hammers may work and they are already glued together.

Happy pinning.

A — From Dave Lamoreaux, RPT

I have had experience with the kind of "seized" action centers you describe and Protek® made the centers return to the same friction they were pinned at before and the problem has never returned (over seven years now). This particular kind of seizure has manifested itself to me only in Asian parts — I don't understand it exactly, but could it be related to how well the lanolin is removed from the bushing cloth and the Protek® restores the lube it needs?

For whatever reason, Protek® sure works awfully well, and why repin except those which do not respond or end up too loose?

Have fun.

A — From John Musselwhite, RPT

I've noticed here that repinning is often the only solution because the centers are loose in the wood and tight in the felt! This seems to occur in many Asian pianos here, not just this brand, either. Is it because the flanges are drying out? Why wouldn't the felt shrink, too?

Incidentally, one "test" for that I've found (accidentally)

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is to dust the flanges with pure talc (this was before I discovered the immense benefits of Teflon® powder for knuckles). If the flanges seize after that and you check them, they're always too loose in the wood.

Anyone else experience this?

A From Steve Brady, RPT

I recently found the condition John describes (center pin tight in bushing and loose in bird's eye) in a Japanese grand about 20- or 30-years old. The piano had been subjected to pretty intense humidity swings (it sat next to a wood-burning stove for many years). Obviously, repinning is a must for Tom if this is the case in his piano.

A From Don Mannino, RPT

Before any work is done, you should call the tech rep and talk it over, see if they have found any other solutions, find out if the piano is still in warranty, and if this would be covered.

Very accurate repinning of one rail can be done in well under two hours after some practice, especially with newish parts.

Problem — The escapement feels like you're falling off a short but very steep and sharp cliff...

Some general ideas:

- It will be much better if the friction in the centers is correct.
- The jacks are possibly regulated too far under the knuckle
- The knuckle shape has flattened
- The action spread is wrong

And many other similar basic regulation / reconditioning points could be listed.

A From Phil Glenn, RPT

We must keep in mind that the problem is with the bushing cloth, not the pins. The felt was not properly shrunk at the factory. Friction causes it to expand around the pin. As a result, some material must be removed. This makes reaming and repinning the best choice. However, in many marginal cases, a 50/50 solution of methanol and water has helped when dried with a hair drier. It is worth trying first. Lubricant alone is not the answer.

Look at the cut marks in the center pin to see if the pin turns when the flange is moved. Repinning or replacement are the only choices when the pin is loose in the bird's eye.

It is likely that 17-year-old knuckles are misshapen and in need of lubrication. If the piano is newer, it is possible that a warranty situation has developed, and the factory representative should be contacted.

A From Vince Myrkalo, RPT

It has been my experience that Protek® will only be temporary in this situation. Actually, I like to do both: repin using Protek® on the bushings.

As for the escapement, it is my belief that those knuckles are too big. Replacement is the thing to do. Use the Renner small ones.

A From Charles Flaum, RPT

I agree, if the friction reduction doesn't get rid of that short cliff feeling at let-off, then it's definitely knuckle size and/or placement problem (geometry problem). Much like quite a few Steinway Ss in the 1950s.

A From Ed Hilbert, RPT

I suspect the "Renner small ones" don't necessarily feel better because they are smaller, but rather because the leather on them is much tighter and does not drag with the jack. Replacing the knuckles may very well work, but I would still heartily suggest that you just try tightening the present leather and see if it doesn't help. I concur with the comments on repinning and lubricating also. Still, if the knuckle leather is loose and able to move with the jack, you will have drag that no repinning and no lubricating will take away. Again, try it on a few and see.

If you find it is loose when squeezing the knuckle between your thumb and finger, it will probably help to tighten the leather. Best bet is to detach leather at one end on the knuckle (See Figure 1), and reglue the leather tightly with a small spring clamp. I modified a bunch of small 4-inch Pony Brand® spring clamps for this purpose.

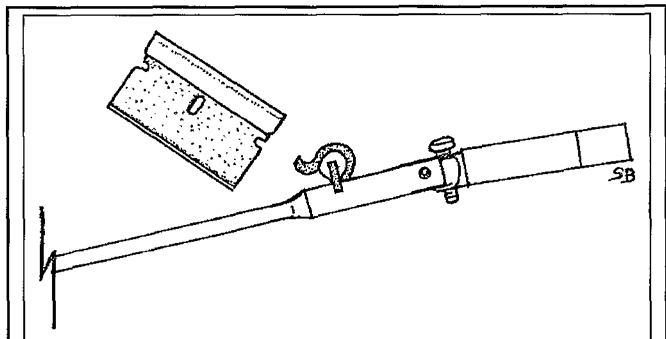

Figure 1 — Buckskin of knuckle loosened on one side with razor blade.

Here is the easy modification. These are Pony #3201 Clamps®. Slide off the rubber tips and you'll see a flat portion at the end of the tip. With a pair of parallel grip pliers, bend the tips in to each other at an angle so they now touch in an angle that will allow you to put the clamp onto the knuckle leather while pressing it in tightly to the core (See Figure 2). After the glue is dry, remove the clamps and then trim the leather. No question now as to the right amount to take off!

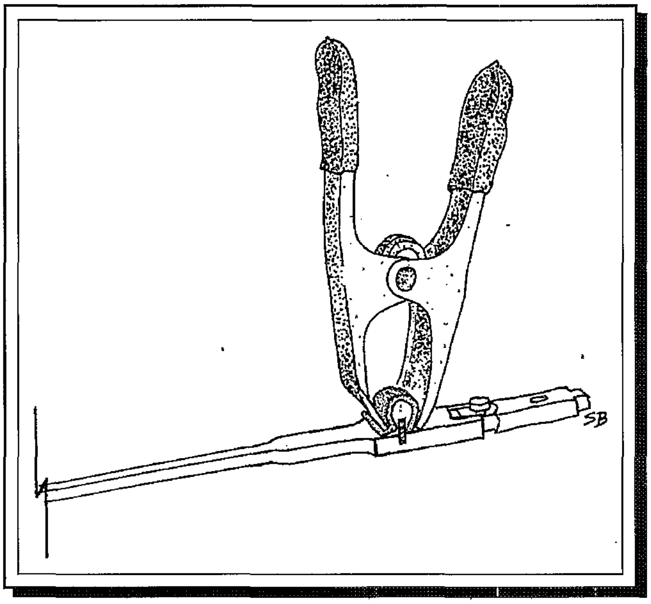

Figure 2 — Buckskin stretched tightly over core and glued. Notice excess leather to be cut away.

You will find this tightening to be of value in many actions that have drag in the let-off. We routinely do this tightening on brand-new knuckles also, since they are usually loose right out of the box. Yes, even on the "good quality" ones if they are loose. It can make a dramatic improvement in actions that feel mushy at let-off as well. My wife, Emily, does a whole set in about an hour and a half, which is cheaper than removing otherwise good knuckles and then installing another set which may very well still not be as tight as you can reglue the first set. Try it and let me know if you like it!

A — From Vince Myrkalo, RPT

This is a simple procedure, and — as far as I know — the leather, once tightened, will not loosen up again. You see, the problem was that the leather was not stretched enough to begin with.

My method: cut the knuckle leather through to the core close to the shank, on the side closer to the hammer. Then, using hot glue from a glue gun, put glue only on the end of the covering, stretch it over the core, hold it there with your fingers for about 10 seconds, or use a spring clamp with the rubber on the ends removed, and you are done.

Just a note on the glue from the hot glue gun. There are many kinds of glue sticks available. I have used the solid white kind with no trouble. Just as long as the thing you're gluing is immediately put together, that type of glue will not move. I have used glue from a hot glue gun for about six years, also using it to glue backcheck leather, and I have found it to be quite adequate. Of course, my biggest reason for using that glue is speed and ease of application.

Postscript

I would like to thank all of you for the many responses I received to my request for advice. It really proves to me that if you put two piano technicians in the same room, you get three opinions and four political parties. I am going to repin all the hammer flanges. I'm going to lube the #%$#%$# out of all the other action centers and if necessary repin those little buggers, too, and I'm going to replace the knuckles. Again — thanks, gang!

—Tom Cobble RPT

Q — Lyre Repair

When a lyre starts coming apart, how bad an idea is it to glue the components together? I have some pedal-stomping customers who cause the side posts of the lyre to separate from the top piece and sometimes the bottom as well. Steinway and other makes have them attached by wedges, but I can't seem to get those to hold for long.

I assume there's a good reason for using wedges. What do I need to do?

— *Mark Graham*

A — From Keith McGavern, RPT

What I do is use a rubber mallet to knock apart the loose parts of the lyre assembly. I clean up the old glue areas, reglue using Titebond®, and then pipe clamps to put it all back together. Let it stay together for approximately 24 hours and reinstall. Just make certain the parts of the lyre go back together properly and not crooked.

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A From Doug Hershberger, RPT

Another trick to try if the lyre is just a little loose is to take the lyre off and run thin viscosity CA glue around the dowels and wedges, make sure there is no trace left on the top of the lyre, then reattach. This might just prevent the above problem from happening later on. I heard Yamaha talking about this with regard to Disklavier lyres which get very hard use from those big solenoids.

A From Newton Hunt, RPT

Lyres with single wedges are glued together. The wedge acts to spread the top of the tenon to prevent the separation you are experiencing (See Figure 3). Drill out as much of the old wedge as possible then knock the pieces apart. Remove the rest of the wedge with a saw and cut new hardwood wedges. Dry-fit the pieces to cut the wedge to proper thickness. It should not bottom when driven in. Carefully orient the parts to prevent reassembly errors, spread a liberal amount of glue (I like Titebond®), bar clamp the lyre together, put glue on the wedges and drive them in tight, real tight.

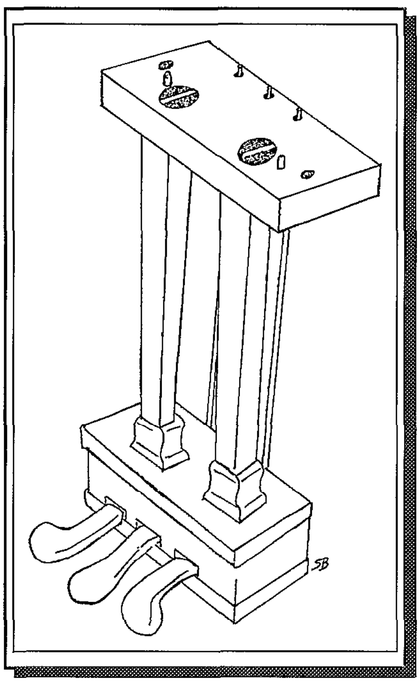

Figure 3

Lyres with double wedges are not glued together, except for the wedges, and can be nicely restored to tightness by clamping and then using a properly cut piece of hardwood to drive the two wedges down to spread the end of the tenon. These are not difficult repairs, they just take some time to disassemble and reassemble all the parts.

I have also successfully used CA glue to reglue a lyre. I spray accelerator around the joint at the bottom to prevent dripping down the verticals. So far so good after three years.

A From Robert Hussa

This idea is related to your questions, so I thought I'd post it. Frequently I've had problems with the entire lyre coming out of the keybed, due to screw mounting tearing out the wood fibers and wallowing out the holes. What to do? Here's a solution given to me by my dear departed stepfather, a gunsmith. I've used it more than once, and it works:

Fill the holes with slow-set (regular) epoxy glue, mixed with fine hardwood sawdust (oak works well). Allow the glue to set up a bit, a few minutes to 30 minutes. Cover the offending large screw threads with a light coating of grease, slowly thread in the screw part way. Glue will ooze out of the hole; wipe it off. Back the screw out, reapply a light coating of grease. Continue until the screw is at the level you need. The grease keeps the epoxy from gluing the screw in the hole. Allow to dry thoroughly with the screw in the hole. You end up with custom-cut threads for the screw which will not pull out. The lyres I've fixed this way are still tight after 10 years of home use.

A From Don Mannino, RPT

Others have written some good repairs, but don't forget something very important: After repairing the lyre, make sure the lyre braces are mounted correctly, with no free play in them at all. A slight forward tension on the lyre (created by the braces) when fully installed will go a long way to prevent loosening glue joints.

A From Audrey Karabinus, RPT

Recently I invested in a pair of Pony®'s reversible-style fittings for 3/4" (internal diameter) pipes. Not every hardware store carries or even knows about these. They mix and match easily with my regular Pony® clamps so I can slide the "fixed" and "crankable" ends of the clamp anywhere along my pipes. I find this immensely helpful in forcing lyres apart. Of course, use wood blocks over the clamp feet to protect the finish. Crank up some pressure, then rap with the rubber mallet, even whack on the tenon ends to push them through (not the best option since it compresses the wood, but sometimes needed). Credit goes here to partner Jack Lofton who is good with a hammer.

Some lyre repairs I run into are not on old pianos, just poorly fitted joints, or square joints with lots of polyester finish in them. If finish is in the joint, I try to remove anything that might lubricate the joint and work against the glue. Most of the joints I've seen have wedges driven into the tops of the tenons. I cut new saw kerfs (let the old wedges alone, many of them are harder and faster than the "wood" they are driven into) and dry-fit new wedges, trying to guess how far they'll bury under pressure. The last one I did, I drove two wedges in per tenon. I use epoxy because it gives lots of set up time — good thing, as more than once I have glued the whole thing up, driven wedges and clamped up only to realize I had one end of the lyre on upside down despite marking everything for orientation. (Best advice: don't talk to anyone while doing this part of the procedure.) The epoxy also fills gaps nicely.

Reverse the Pony® clamps to clamp up and let sit overnight. Use reinstallation as an opportunity to check that the lyre braces hold the lyre like a rock.

A — From Mark Story, RPT

Some technicians are tempted to repair these broken lyres by drilling horizontally through the lyre top block, right through the vertical members, and gluing dowels in the holes. This doesn't solve the problem. What you end up with is a lyre that will loosen again as soon as the glue breaks — loosens, but does not completely fall apart if you're lucky. If you're not, the lyre tenons will come apart because you have severed the grain where you drilled the horizontal holes. Now try to fix it! Stick to the proper method, outlined here by others, of drilling out the wedges, cleaning it up, and reassembling with new wedges.

A — From Tom McNeil, RPT

Just last week, I had the challenge of repairing the lyre on a Steinert (imitation Steinway) grand. The upper member, which mounts to the bottom of the keybed, had broken years ago. This was probably because the lyre was mounted without the diagonal braces once upon a time. A functional repair was done by gluing up the fracture and reinforcing the whole business with two half-inch wooden dowels going front-to-back into this upper member. The dowels were not carefully spaced, and each intersected an upright member of the lyre, one just barely. Well, the original mortise & tenon joints failed — as they so often do. However, in this case, the joint was locked together (but not very tightly) by the dowels, rendering disassembly difficult. I bored out the dowels, disassembled the lyre, then repaired in the usual fashion. When all was sound again, I decided to replace the dowels. (Maybe the earlier technician had reason to doubt the strength of his repair?!) I rebored the holes, this time going all the way through. Cut two half-inch steel dowels (Old Elmer used to call 'em, "Swedish dowels.") to length and drove them in without glue. Ship builders call these "drifts," and they work just like giant nails. They will hold forever with just their friction fit, and they're tremendously strong. Best of all: should they need to be removed again, they may be driven out with a hammer and punch.

Another idea I've used is to drill holes just a little bit undersized for a tuning pin through the top block and into the upright members. Then tuning pins can be driven in to reinforce the joint. If these are left protruding half an inch (or whatever) they can be removed later by unscrewing them.

A — From Steve Brady, RPT

Regarding horizontal dowels and Swedish dowels, I should mention that before you set about forcing a lyre apart to repair it, you should always check to make sure it hasn't been doweled or otherwise reinforced horizontally. Along the same lines, check to make sure there are no nails or brads driven horizontally into or through the vertical members. I've found such nails even in relatively new pianos (sometimes they're hard to spot), and believe that some makers put them there in the factory. If you don't look for these things and remove them before trying to force the lyre apart, you could have a much bigger repair job on your hands!

Understanding Tenor Break in Stringing Design

By Chris Day
Boston Chapter

Anytime a piano is restrung, it is logical to ask whether the new string set might be modified to enhance the tone of the piano. It is difficult to appraise the situation and make a recommendation if the underlying conditions that lead to the problem are not understood. This is an attempt to look at the difficulties encountered by the scale designer and the role of string design in the solution. It is written only from the viewpoint of string design and ignores the tone reproduction system and several important second-order considerations to make the discussion manageable.

Around the turn of the century, scale design was a black art performed mostly graphically, and the techniques were held as closely guarded secrets. Few were indoctrinated into the sacred fold.. Lesser piano makers, not having their own scale designers, often copied and modified existing designs for their own use, usually with little understanding of what they were doing. The results were predictable: many pianos were sold with problematic scales which were difficult to tune and had poor tone. The situation was usually worse around the tenor break.

Today the mathematics of string scaling have been established, and there are a number of programs available for use on home computers that enable the technician to perform string rescaling. Unfortunately, scale design is regarded by many as merely having moved from the province of black art to the province of pointy heads. The mathematics is a little intimidating and there is a certain justification for this attitude, however, the general principles are comprehensible.

In the plain-wire section of the piano there are two "input variables" to be specified for each note in the scale: the speaking length of the string and the diameter of the string. The parameters that the designer tries to optimize are the string tension and the inharmonicity. Inharmonicity is not an evil incantation of the pointy heads, it is simply the effect that the stiffness of the string has on the partials, making them sharper than they would be in, for instance, an organ pipe. This effect is present in all strings but is most pronounced in the treble. It is unavoidable in modern high-tension pianos, and the tonal results of inharmonicity have come to be associated with the piano, so that simulations without inharmonicity do not sound "piano like." Tension is important in that it sets a limit on the amount of energy that a string can store, and thus the loudness of the note.

The objective of the scale designer is to have all notes sounding the same loudness and to have the tonal characteristics of the piano progress smoothly up the piano. To do this, all plain trichords should tune at the same tension, and the inharmonicity should rise from the tenor to the treble at a smooth and constant rate. This is what makes a piano sound even and makes all the intervals progress smoothly, which in turn makes it nice to listen to and to tune.

In the high treble, the requirements of maintaining tension without approaching the breaking point of the string give the scale designer few choices. The 2nd partial of C7 ends up about 18 cents sharp and the 2nd partial of C8 about 45 cents sharp! The bridge is designed so that it sweeps away from the hammer contact line in a nice smooth exponential curve, preferably with dog legs where the bridge passes under the plate struts and the string spacing has a gap.

This design can give nice smooth curves to the inharmonicity (straight lines on logarithmic paper), maintaining nearly constant tension if the string sizes are chosen well. The bridge runs into trouble in the tenor because if this shape were to be continued, the bridge would stick out of the back of smaller pianos! The usual solution is to reverse the curve and to curve the bridge back towards the hammer contact line to keep it close to the center of the soundboard, leaving room for the bass bridge. The tenor strings are now shorter than they should ideally be.

The result is that the string length for a given note is set by mechanical limitations, not musical considerations. With the length fixed, the only variable left is string diameter. If, for a given note, the string is made thicker, the tension will increase, the stiffness will increase and the inharmonicity will increase. The strings in the tenor are too short, so that either they must be made thicker to lower the pitch while maintaining tension thus raising the inharmonicity, or the inharmonicity may be lowered by reducing the thickness of the string thus lowering the power and giving a weak tenor section. Two desired properties cannot be independently optimized with only one parameter to manipulate.

If the designer favors power, and power is what the modern high tension piano is all about, then the inharmonicity will have an upward hook in the tenor section. The bass, normally all wound strings, will hopefully be close to the ideal curve. This will leave a marked discontinuity to the curve between the bottom of the tenor and the top of the bass and make a piano that is very difficult to tune. Any interval that crosses this break will have unexpected beat speeds and will not relate to intervals that do not cross the break. Adjacent thirds in the "hook" area will not progress as expected. This is the tenor break problem. There is no good plain wire solution other than a longer piano, only a choice of compromises.

Wound strings have more variables to manipulate. The stiffness is a result of the core, the tension is a result of the weight, mainly the wrap diameter. In addition, the bare ends of the string where the wrap ends short of the speaking length increases the inharmonicity of the string. There are thus more input variables than desired properties to optimize and both tension and inharmonicity can be optimized independently. The "hooked" area in the tenor section can thus be corrected if it is strung with wound strings. This was often done in the past with wound trichords. These can be difficult to tune and to damp properly. An alternate solution is to use wound bichords. This lowers the cost and eases the damping and tuning problems. The loss of one string and the consequent loss of output power must be compensated for by adding tension, about 15 percent more. There is enough reserve left in the breaking strength to do this in the tenor.

This solution works very nicely, but before you rush out to try this there is one further "gotcha." The ideal wound string design in this area would require a very fine wrap. Unfortunately, for practical reasons, it is not easy to wind copper that is thinner than about .007 inches in diameter. If a replacement wound string is designed with this minimum wrap it will now have too little inharmonicity! Out of the frying pan into the fire. Fortunately there is another way to raise the inharmonicity back up and that is to increase the bare length of the wound string. This is why you see those long bare ends on the tenor wound strings in better new piano designs. Winding with aluminum, also done at the turn of the century, does not really help because, although aluminum is much lighter than steel, the minimum wrap diameter that I have seen is .012 inches, or twice that of copper.

There are many other areas that could be discussed, such as the scaling of the bass section and correcting for absence of doglegs in the treble strut area, but this is probably more than enough for one article. I have also presumed that the technician does not have the temerity to change the speaking length because this involves modifying the bridge, which is difficult to do and is often constrained by plate design. I must also emphasize that I have not considered other secondary, but important parameters, such as hammer contact time and have completely ignored soundboard effects. This was done in the interest of making the subject manageable and limiting the changes to properties that can readily be modified during the process of restringing.

As an example of tenor-break rescaling I show data using an old Mason & Hamlin A. This piano has a typical long bridge shaped like a field hockey stick. Look closely at Graph 1. The tenor break is between notes 26 and 27. Several comments could be made about this scale design. The middle section around note 35 is too low in inharmonicity while at the same time the tension is too high. Since changing the wire size raises both curves simultaneously, the problem cannot be solved by choosing different wire sizes in this area. The high bass also lacks power (tension), relative to the midrange of the piano. There is a most noticeable break in both curves at the tenor break.

Wound bichords were then substituted for plain trichords for notes 27, 28 and 29 (See Graph 2). Since bichords should have more tension than trichords the tension of these three notes has been raised. The inharmonicity curve is now much smoother. Inharmonicity can be adjusted independently of tension by changing the bare lengths. The big change, however, is in the percent breaking point of these three strings. Look now at the two breaking-percent graphs (See Graphs 3 and 4). The limitation of minimum wrap-wire size forces a reduction in the core size if the outer diameter, which governs tension, is to be correct. This puts a much higher stress on the core, though is still within the recommended 66 percent maximum. It also lowers the inharmonicity too far and that has to be raised by

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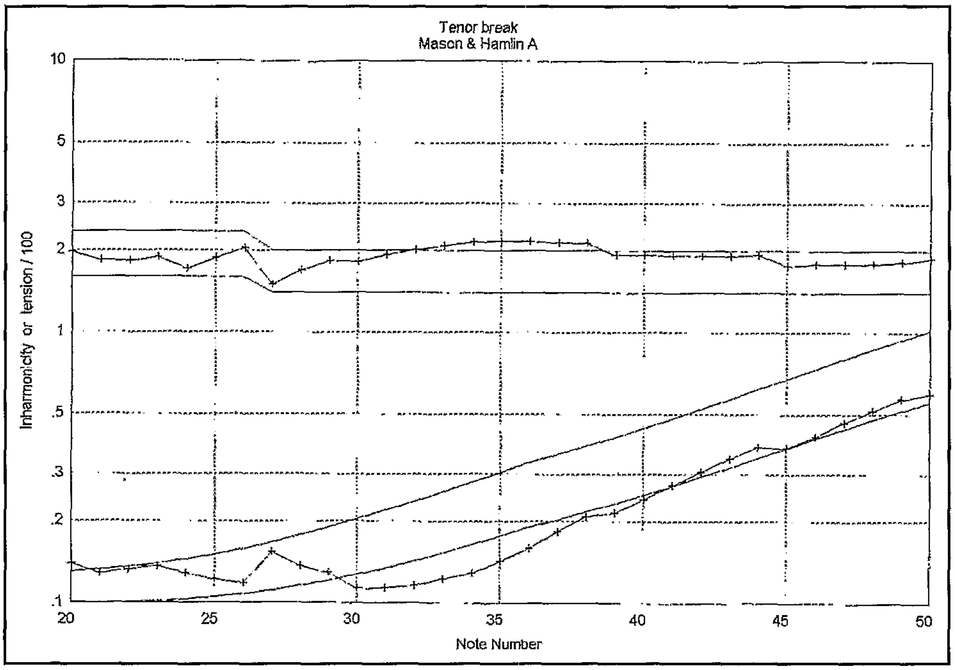
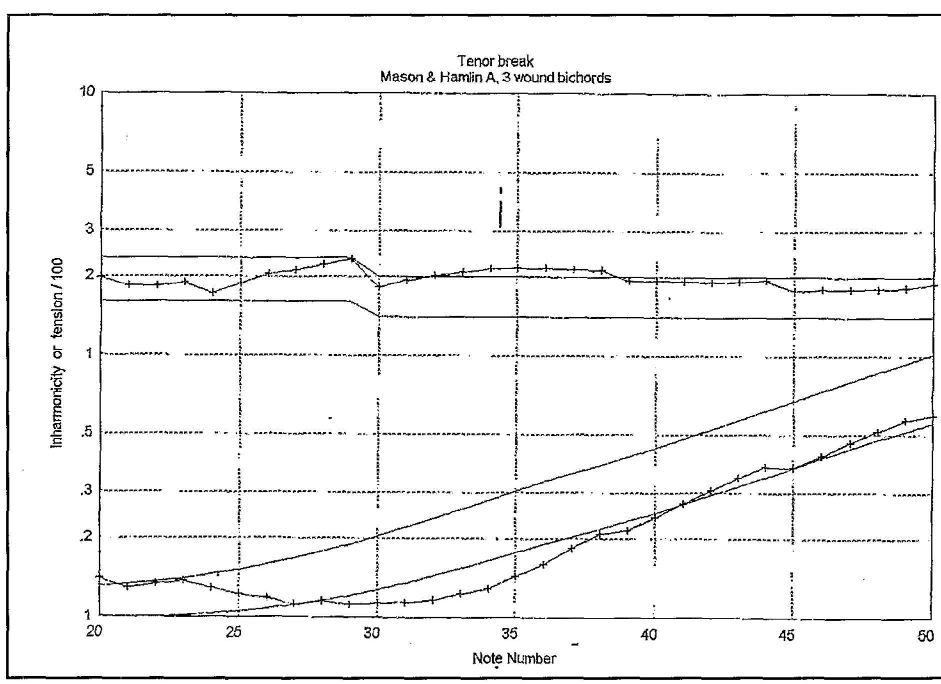


Graph 1



Graph 2

Understanding Tenor Break in Stringing Design

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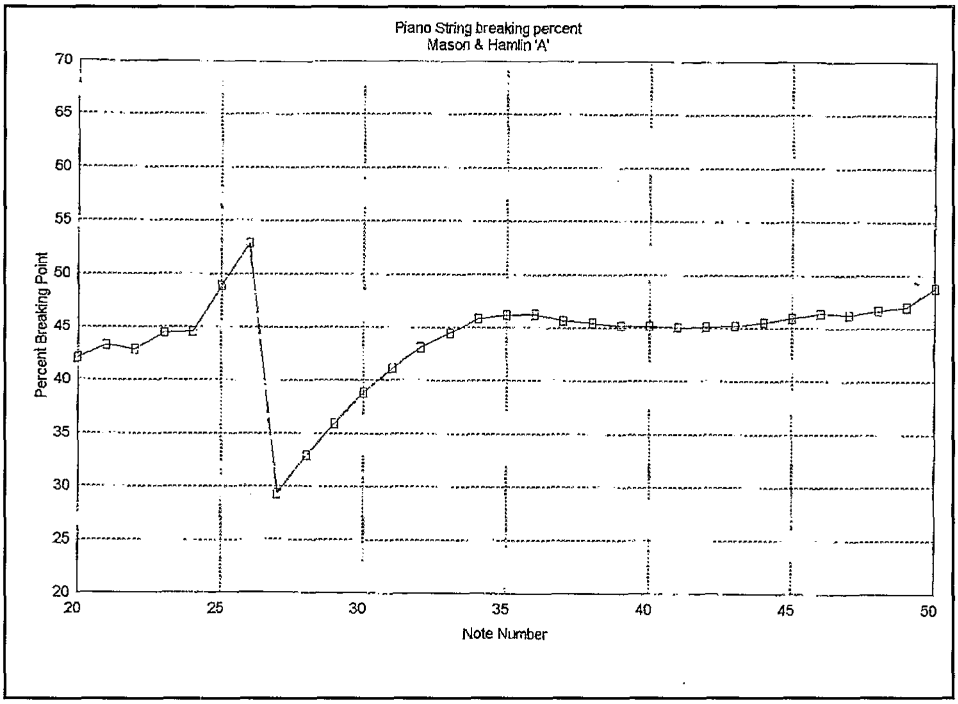
having bare lengths of 1.2 inches.

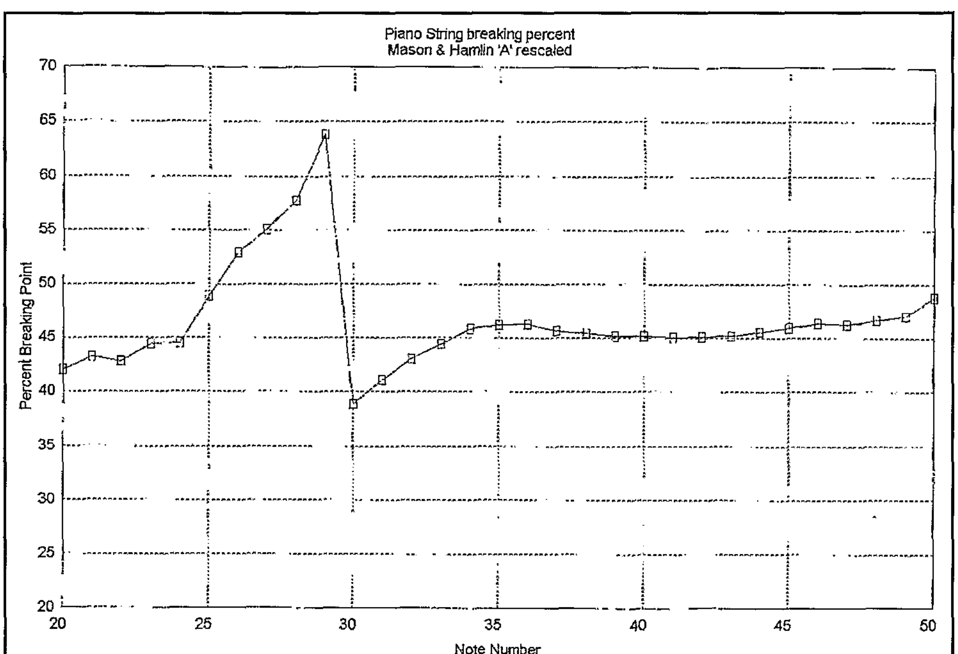
In passing, I would note that to raise the inharmonicity of note 33 to a level above the minimum line would require shortening the speaking length by two inches. To correct problems in note 27 would require increasing the speaking length by three inches!

My thanks in particular to Dr. Al Sanderson who has done so much analytical work on piano scaling and who has shared his results so readily with us and to Universal Technical Systems, Inc., who provided me with a copy of TKSolver to accomplish the mathematical research. I would also like to float the suggestion of a national registry of piano scaling fixes that technicians could draw upon, thus making the effort of scale changes more than a one-shot affair.

More on that some other time.



Graph 3



Graph 4

Action Power

Part I — Exploring the Limits of Piano Action Dynamics

By Delwin D. Fandrich, RPT
Contributing Editor

Introduction

Several years ago we brought a Steinway Model D grand into our shop for repairs. The piano had been located fairly close to the Puget Sound since new (roughly mid-1970s). The strings were somewhat rusty and the tuning pins were a bit loose. But the most bothersome problem was the sound — the piano was simply weak. Sustain was OK, but the piano lacked the kind of acoustical power expected from a concert grand. Since our initial examination of the piano took place while it was located in a moderately sized bedroom in a private home, this lack of power was a matter of some concern. I discovered that, among other things, the downbearing was grossly excessive — the top of the tenor bridge was nearly in contact with the longitudinal plate strut between the tenor section and the first treble section. It appeared that the plate may have been installed somewhat low, and this subsequently turned out to have been the case.

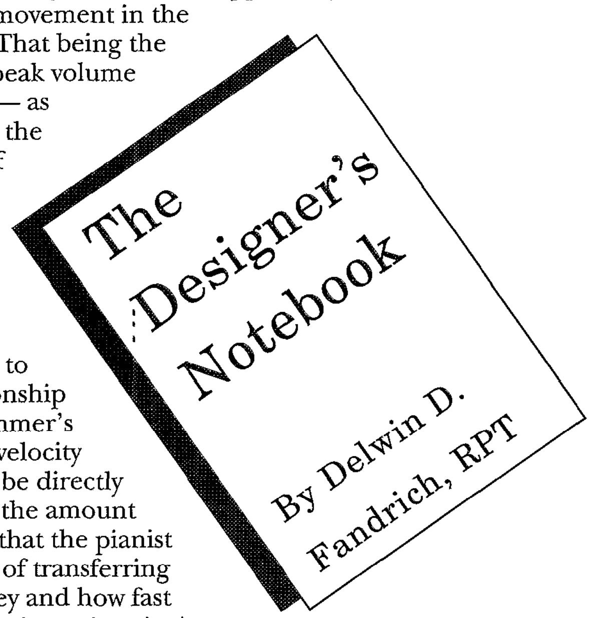
In what was hopefully a temporary bout of stupidity, I then made the mistake of assuming that this was the only cause of the power problem, stopped looking, and we proceeded accordingly. Once in our shop, we replaced the pinblock, raised the plate to establish proper downbearing and proceeded to reassemble the instrument. With its new hammers, new strings and improved downbearing specifications the tone quality had certainly improved. Output power also improved, but not nearly as much as I had anticipated — and hoped — that it would. So now what?

Finally, after much head scratching, the little gray cells belatedly kicked in: I noticed that — on even a medium blow — there was a small but perceptible time lag between the time that the key hit bottom and the audible impact of the hammer against the string. The problem grew worse as we went from the mid- to low-tenor down into the bass. Of course! ***Action saturation.*** *And therein lies this tale ....*

Key Velocity vs. Sound Power

For decades, pianos have been designed on the premise that the soundboard functions like an amplifier. Old — indeed, some current — piano literature is full of explanations of how the soundboard *amplifies* the *sound* in the strings and makes it louder. If this were true — assuming all else to be equal[1] — pianos of the same length but with larger soundboards would *always* be capable of producing higher volume levels — more power — than those with smaller soundboards. This is assumed to be true since *large* amplifiers are capable of putting out more power than are *small* amplifiers, right? However, piano soundboards are not amplifiers. They are actually transducers that act much more like loudspeakers. Still, this misconception has led to the development of many pianos with soundboards that are very much larger than their optimum size in the elusive search for louder and "more powerful" instruments. The problem is that the ultimate power output of a piano is almost never limited by the size of the soundboard[2]. Okay, before your cards and letters start coming sentencing me directly to jail — not even letting me pass *"go"* — for my heresy, there may be one or two exceptions out there somewhere — pianos that have been built with soundboards that are actually too small — though they'll be pretty rare. For the rest, as we'll see in this article, the "power output" is limited primarily by the mass of the hammer (plus some fraction of the hammershank's mass)' and the velocity at which it is traveling when it impacts the string or strings related to a given unison. In other words, the peak volume level of any given piano is going to be limited by the amount of energy that the action is capable of transferring from our finger to the hammer and hammershank assembly when we strike the key driving it. The amount of kinetic energy (**Ek**) in a hammer assembly when it impacts a unison string set is described by the relationship $\mathbf{Ek = 1/2\ MV^2}$, where M = *mass* and V = *velocity*. From this simple relationship, you can see that the kinetic energy in the hammer varies directly with the mass of the assembly and with the square of its velocity.

Being piano technicians, whose most intimate contact with the piano action occurs during the times we are servicing or regulating it, we generally assume that a piano action's hammer motion is very directly related to the movement of the key driving the action mechanism. When we regulate an action, after all, we can see that any movement of the key results in an apparently instantaneous resulting movement in the hammer. That being the case, the peak volume potential — as limited by the amount of energy available to the strings from the hammer according to the relationship of the hammer's mass and velocity — should be directly related to the amount of energy that the pianist is capable of transferring into the key and how fast that energy is put into it. As the pianist strikes a piano key faster and with increased force, we expect that hammer velocity will increase propor-



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tionately and, with the mass of the hammer and the hammershank being a fixed quantity, the resulting sound output power should also increase by some given ratio becoming louder and more powerful as both key velocity and hammer velocity increases. So, in theory, all the pianist should have to do to get more volume out of a piano is to strike the keys harder and harder and faster and faster with the only limitation being the physical strength and speed of the artist's arms and hands. And, up to a certain point, that is essentially what does happens. Beyond that point, however, no matter how much more energy and speed the pianist is capable of putting into a key, the piano's power output simply peaks out and it will not sound any louder no matter how much more vigorously the artist attacks the keyboard.

On examination, we find that every piano action has a certain threshold beyond which it becomes incapable of transferring any further energy input from the pianist's fingers through the key and into the work of accelerating the hammer. Beyond this point, the hammer velocity will simply not increase any further—no matter how much additional energy is put into the key. Since the velocity can't increase any further, the peak power output of the piano can't increase any more either. So, the absolute limiting factor in piano sound power output is actually the design, the construction, and the condition of the action and the efficiency with which it is capable of transferring energy from the pianist's fingers to the hammers and ultimately to the strings. No matter what we do with scale design, soundboard design or rim and structural design, if we can't get the energy through the action and into the hammers, we'll never get it into the soundboard.

Action Saturation & the Action Saturation Level [3]

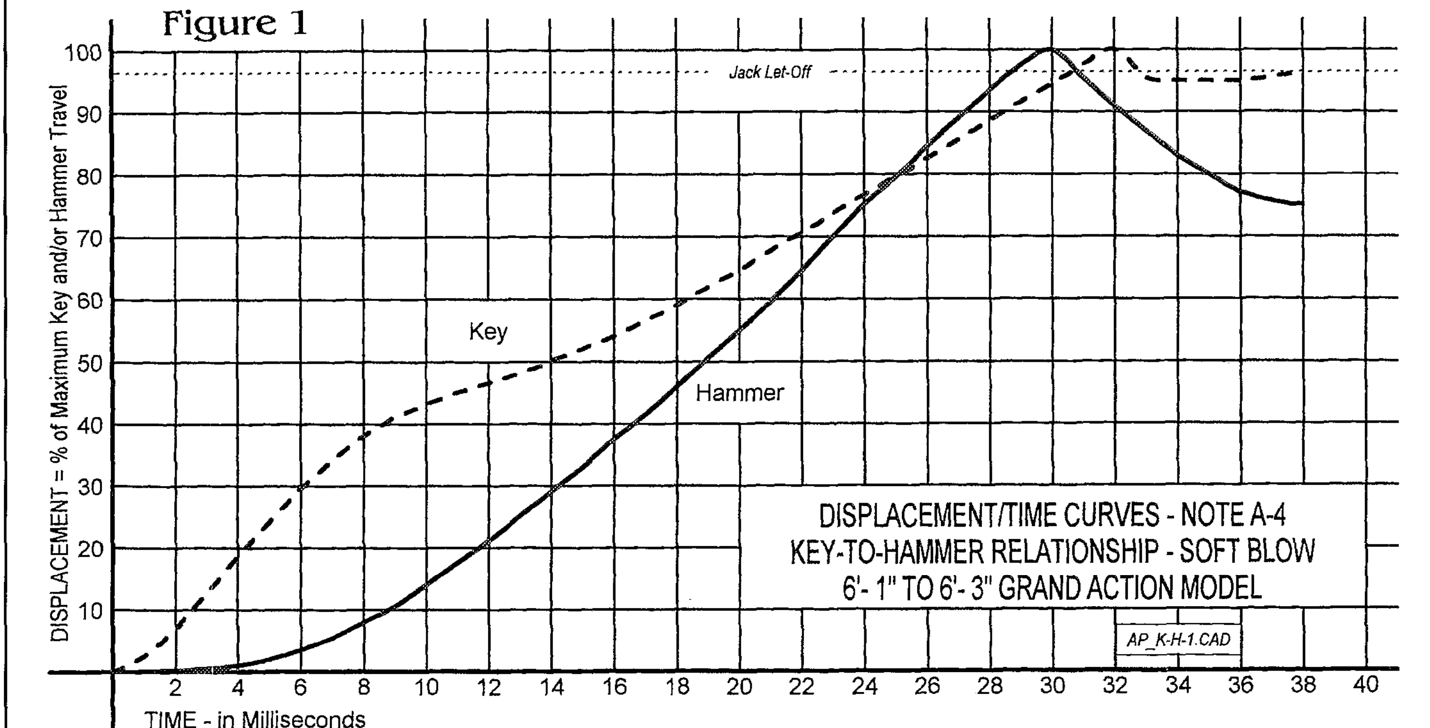
The point in any given action at which further increases in key velocity are no longer reflected by resultant increases in hammer velocity is known as that action's ***saturation level*** and the phenomenon is called ***action saturation.*** The sound pressure level at which no further volume will be obtained no matter how much harder or faster the key is struck is called the saturation sound pressure level. Effectively, the ***saturation sound pressure level*** is the maximum volume level at which any given piano can be played, regardless of its size.

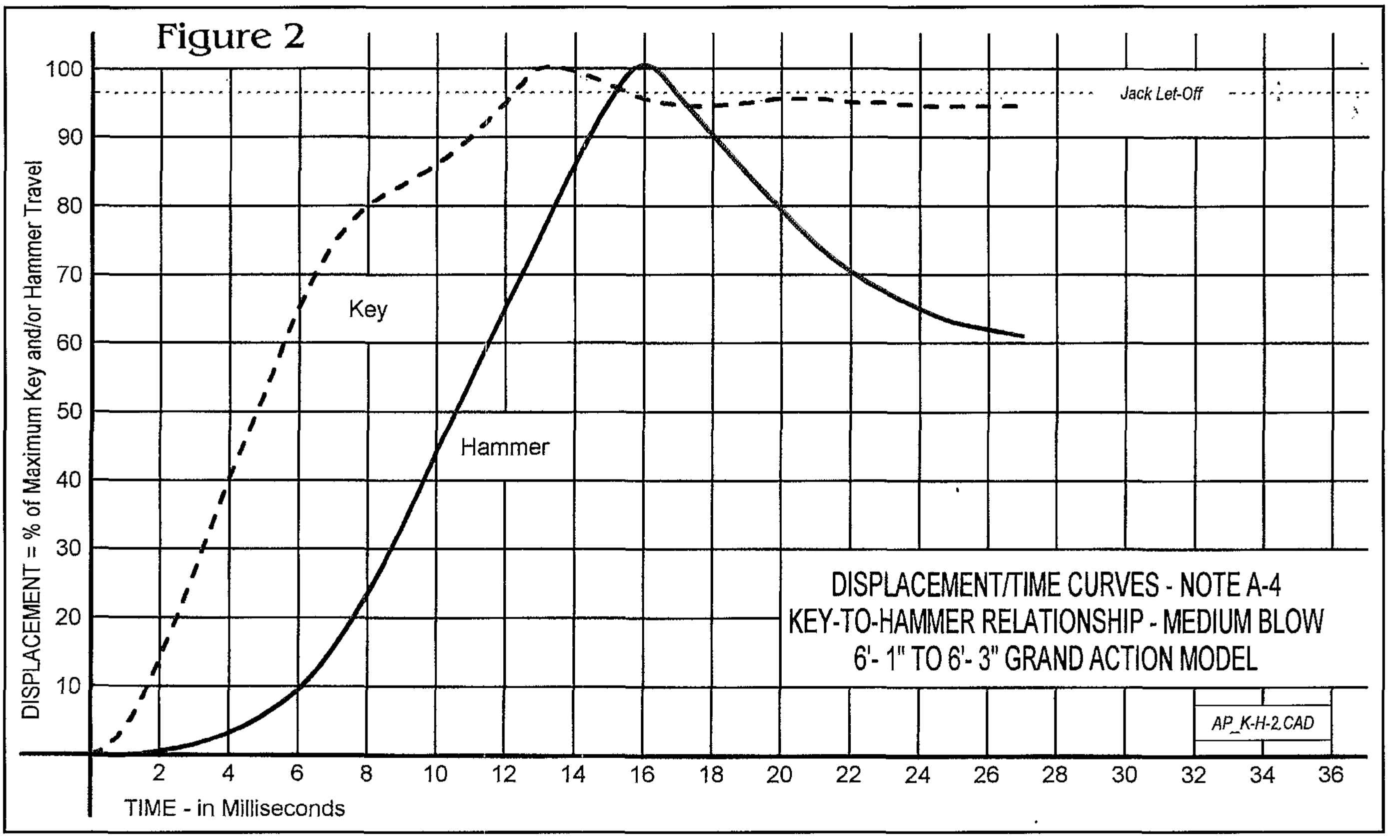
The action saturation level will vary from action to action, and to some degree, from key to key within a given action. Actions found in pianos of different sizes will have different saturation levels. Actually, as we'll see more clearly in *Part II* of this article, it is more a function of key length. Assuming keys of the same basic design and hammers of the same mass, actions with longer keys are not capable of accelerating hammers to velocities that are as high as those that can be attained in actions with shorter keys. And, since longer pianos have actions with longer keys, the hammers in these pianos generally don't reach velocities as high those in shorter pianos.[4]

Hammer Velocity & Piano Volume

Over the years a variety of studies have been conducted by researchers and manufacturers that relate hammer velocity to the volume, or the ***sound pressure level (SPL),*** of a piano. (See *What is Sound?* following this article) It has been found that within reasonable limits the sound pressure level produced by a piano is directly proportional to hammer velocity. Doubling the velocity of the hammer at impact increases the kinetic energy in the hammer by four times

Figure 1





(remember the V^2 component in the formula above). This increase in energy input to the strings ultimately raises the power output of the soundboard by a factor of four — actually a bit less in the real world, since there are some losses in the tone generating mechanism of the piano that have to be considered. With acoustical, or sound intensity being proportional to the square of sound pressure, the end result is that sound pressure is (more or less) directly proportional to hammer velocity.

The peak sound pressure output of a piano increases by approximately 6 dB each time the hammer velocity doubles. This represents a doubling of the sound pressure level, but it takes an increase of about 10 dB before the sound subjectively seems twice as loud as detected by our ears and interpreted by our brains. (A 3 dB change is the smallest change in volume that the average human ear can reliably detect. See *Measuring Sound Power* following this article.) Actually, since our ears do not respond uniformly to sound energy throughout the frequency spectrum, our subjective evaluation of a piano's power output depends less on the fundamental frequency of the note being played than on the peculiar power distribution in the harmonic spectrum generated within the strings each time a note is played. The power distribution among the various harmonics excited will vary with the scale design of the piano and with the design and condition of the hammer and with its velocity at impact. Our ears respond much more readily to sounds in the 2,000 to 5,000 Hz range than they do to sounds above or below this range and they are most sensitive in the 3,000 to 4,000 Hz range — roughly the top octave of the piano scale. Of particular interest to us is the problem of how insensitive our hearing is to frequencies in the 20 to 200 Hz range — basically the first three octaves of the piano scale. The sound pressure level of a 50-Hz tone — approximately the fundamental frequency of G-1 — must actually be about 15 dB higher to sound as loud, subjectively, as a 1,000-Hz tone — approximately the fundamental frequency of B-6.

Key Velocity vs. Hammer Velocity

Useful key velocities in typical grand pianos vary from about 0.1 meters per second (m/s) up to about 2.0 m/s for a fairly hard blow. Key velocities below about 0.1 m/s will not provide enough acceleration to the hammer for it to reach the strings after the jack leaves contact with the knuckle. At the other extreme, an experienced pianist will be capable of driving the keys to velocities somewhat higher than 2.0 m/s, but with most typical piano actions there will be little to be gained by driving the key any faster than this. Resulting hammer velocities will vary somewhat with the design of the action, its condition and, to a very large extent, the length of the piano.

Depending somewhat on how well-regulated the action is, a piano hammer must reach some minimum ***escape velocity*** — the velocity of the hammer at the instant the hammershank knuckle leaves contact with the jack and is no longer driven toward the string by the action mechanism — of around 1.0 to 1.25 m/s to have enough momentum to reach the strings and create some minimum level of useful sound. At the other extreme, again assuming a typical action mechanism in good condition and regulation as well as being one which is very efficient at transferring energy, hammer velocities can reach as much as 6.0 to 7.0 m/s when the keys are struck very hard. Within this range, a good pianist can very precisely control the volume of the piano by varying how fast and hard he or she presses on — actually, *hits!* — a particular key.

Since there is a direct mechanical link from the key to the hammer it would seem that hammer velocity should increase in direct proportion to key velocity. Unfortunately, as suggested earlier, it doesn't. Hammer velocity increases in

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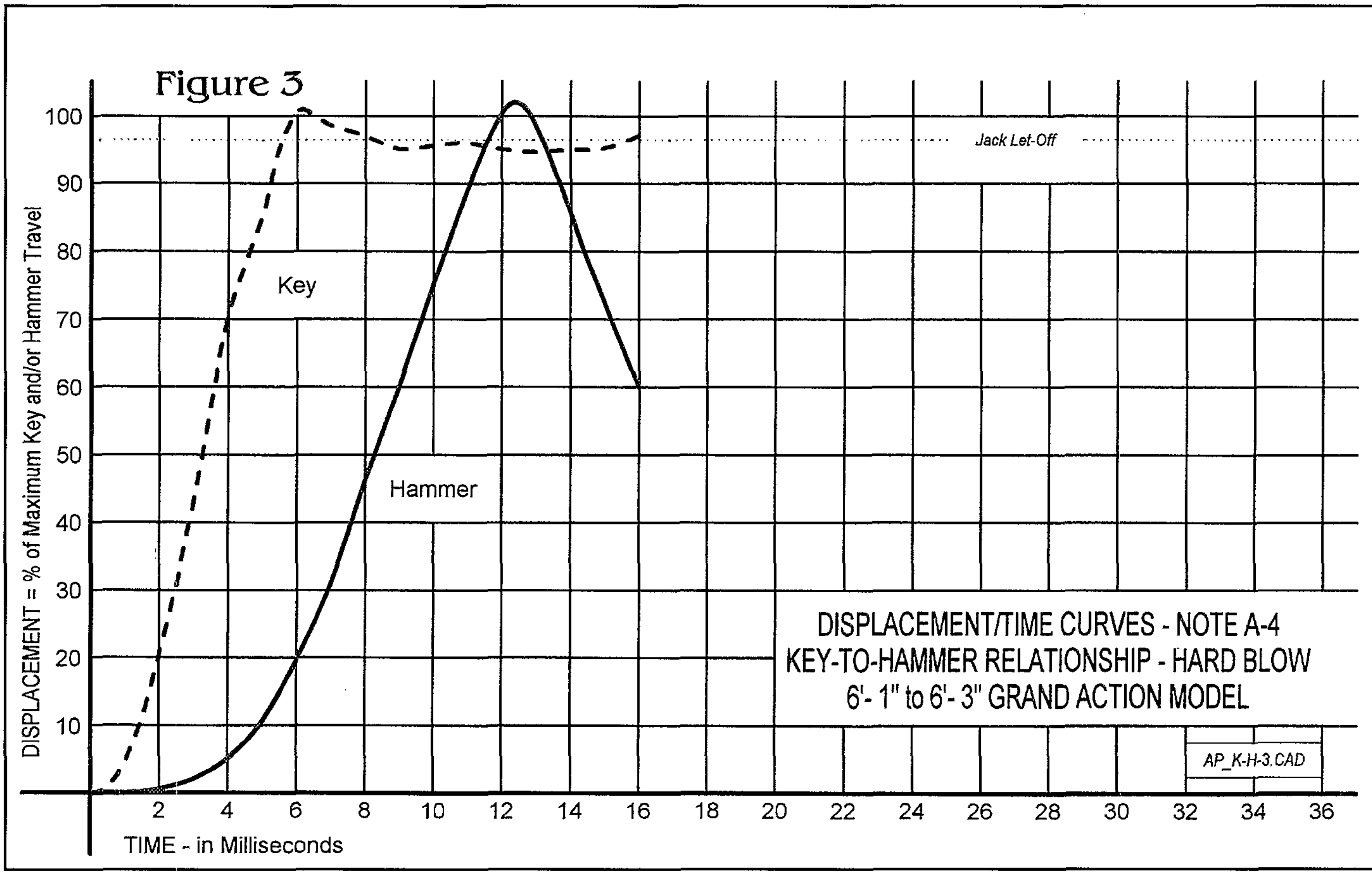

approximate proportion with key velocity until a point is reached at which the action assembly is no longer capable of transferring all of the input energy from the key to the hammer. Beyond that point, increases in hammer velocity begin to lag behind any increases in key velocity until a point is reached at which neither hammer velocity nor piano volume will increase any further no matter how much harder the key is played.

The ***Displacement/Time Curves*** shown in the accompanying graphs illustrate what happens to the hammer using key strokes of various intensities.[5] Figure 1 shows the relationship between the key movement and the resulting hammer movement when the action is played at a strong *pianissimo* level. Notice that the end of the key has been moving for nearly 3 milliseconds (ms) and has used up approximately 20 percent of its maximum available stroke before the hammer begins to move. This delay is due to ***action slack.*** During this time the end of the key has been moving but that motion has been taken up by various parts bending, twisting and compressing — more on this in *Part II* of this article. At about 6.0 *ms* into the keystroke, energy has been transferred through the key and the various action parts to reach the hammer and it begins to accelerate in earnest. Until this point the key has felt little resistance, but now the shock of accelerating a relatively heavy hammer begins to be felt back through the action, slowing the key slightly. This is seen as a mild hump in the key displacement/time curve. At about 22.5 *ms* the movement of the hammer actually catches up with the movement of the key and passes it actually arriving at the string about 2.0 *ms* before the key bottoms against the front rail punching.

Figure 2 shows what happens with a medium blow. Again, the key has been moving for some brief time before the hammer begins to move. It's only about 2.0 to 3.0 *ms*, but during this time the key has again traveled about 20 percent of its stroke. By the time the hammer really gets under way after about 6.0 *ms*, the key has already traveled 65 percent of its total stroke. The hump is still there, but now it takes place about 8.0 *ms* into the sequence and after it has traveled about 80 percent of its total stroke. The key bottoms out about 3.0 *ms* before the hammer impacts the strings.

Figure 3 indicates what takes place using a moderately hard *fortissimo* blow. Note, this was not an abnormally hard blow. We weren't trying to break either the key or the action. It would not take a very aggressive pianist to duplicate playing at this level. The hump in the key curve is now barely discernible and the key bottoms out about 6.5 *ms* before the hammer strikes the strings. This means, of course, that for the last 80 percent of the hammer's travel the pianist does not actually have any effective control over the motion of the hammer. And, aside from literally throwing the hammer at the strings, neither does the action. So much for "power" regulating!

Notice especially what is happening to the relationship between the period of time between the key bottoming out and the hammer impacting the piano string. In Figure 2 there was a 2.5 to 3.0 *ms* time lag between the key bottoming and hammer impact. In Figure 3 there is a 6.5 *ms* time lag between the two. The action is approaching complete saturation.

Figure 4 shows the result of an even harder blow — still well within the range of any reasonably energetic pianist. Notice that in Figure 3 the key bottomed out about 6.0 *ms* after being struck and the hammer struck the string about 6.5 ms later, or about 12.5 *ms* after the sequence was initiated. In Figure 4 the key bottoms out only 4.0 *ms* after being struck — fully 2.0 *ms* sooner than in the sequence in Figure 3. However, the hammer does not reach the strings until nearly 8.0 *ms* later, or about 12.0 *ms* after the key is struck. This is only 0.5 *ms* sooner than the sequence of Figure 3.

And that's it. No matter how much harder the key is hit beyond the level shown in Figure 3, the hammer is simply not going to get to the string any sooner or faster. In this particular action, the pianist has the ability to control hammer velocity up to about the level indicated in Figure 3 by varying the velocity of the key. Going beyond that is simply wasted energy.

There are probably different saturation levels for different action styles as well, though I suspect that in most modern action designs it will fall within a fairly narrow range. I have only tested one specific style — a modern butterfly spring design — that was modified to enable it to use keys of various lengths. The illustrations given — Figures 1 through 4 — were developed from tests using a key length typical to a 6'-1" to 6'-3" piano.

All of this leads us to the question: if improvements or modifications can be made to the piano action to take advantage of higher key velocities, are increased hammer velocities possible? Along with higher hammer velocities would come higher sound power levels. Can this increased sound power be obtained without any *readily apparent* acoustical side effects? The short answer to both questions is, "yes ... but!" There may be other adverse effects that raise their ugly heads.

Distortion

Before closing, we should look at what may happen to the tone quality of a piano if we do increase hammer velocities beyond their traditional levels.

When a piano hammer impacts a string, or a unison of strings, it initially sets up a broad spectrum of essentially random vibrations that I call *impact string noise.* It takes some short, but finite, period of time for these random vibrations to settle down into a coherent waveform based on some fundamental frequency and the various harmonics that a particular string or string set can sustain by natural oscillation. How long it takes for the waveform to become coherent depends, in part, on how hard the string is struck and how hard the hammer is that is doing the striking. In other words, how massive the hammer was, how dense it was, and how fast it was traveling.

The frequency spectrum of the sound envelope being created in the strings and being fed into the soundboard changes as the hammer velocity increases. Not only does the overall power level increase, but the frequency spectrum — including the relative amplitudes of the fundamental and each separate harmonic — changes as well. It is this characteristic of the piano that gives it its distinctive and ever-changing tone characteristic. At low hammer velocities and the subsequent low volume levels there will be little hammer impact noise heard and the sound output will be made up of predominately the fundamental oscillating frequency and the lower harmonics of the string[s]. The sound will be warm and lush. As the hammer velocity increases hammer impact noise becomes a greater part of the overall sound envelope and the sound becomes more percussive. There will be a sharper, "noisier" impact sound. In the strings, the shorter partials are excited to a greater extent and the higher harmonics are heard as a stronger part of the wave envelope giving the sound a brighter, harder, edge.[6]

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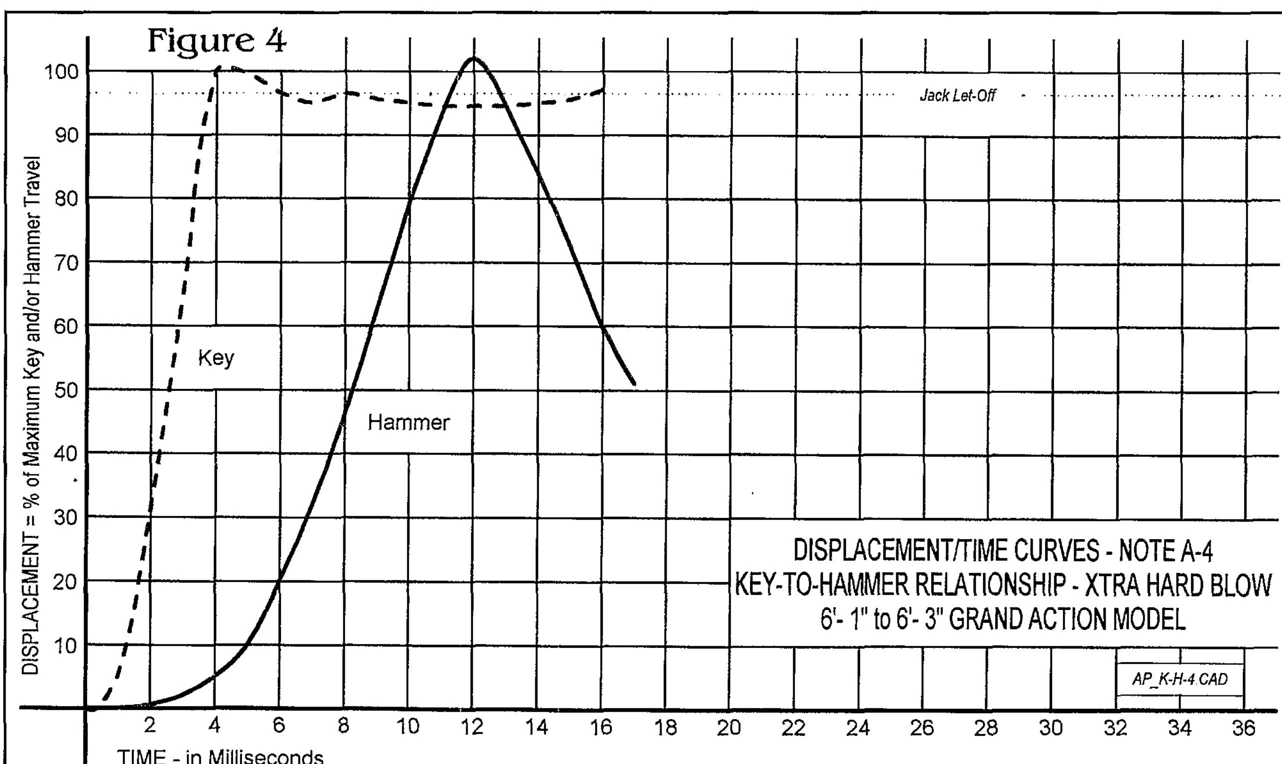

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The concern — acoustically — is that by increasing the hammer velocity beyond the accepted norms, at some point we will drive the string into "distortion." Distortion in a sound reproducing system can be defined as any deviation in the output waveform from the original signal input — any level of unfaithful reproduction of the original is distortion. Since the piano is the producer — not a reproducer — of the sound, distortion in a piano is harder to define and probably should be the subject for another article. Basically, I define distortion as any sound generated by the piano that is discordant to the fundamental frequencies of the note, or notes, being played regardless of the source of that discord. Distortion generally comes from one — or a combination of — three sources:

- From within the string itself such as a longitudinal wave in a bass string. I include so-called "false" beats — whatever their cause or source — in my description of distortion.
- From one or both of the string's termination points such as the noises created by an incomplete string termination such as those caused by a poorly shaped V-bar or a loose bridge pin. The end sections of the strings, whether front or back or tuned or un-tuned.

(By the way, if anyone else has come up with a better definition for distortion as it applies to the piano, I'd be grateful if you'd share it.)

But with a properly designed hammer and a stringing scale adequately terminated, distortion should not be evident even with hammer velocities well beyond those obtainable from conventional actions and keys.

In *Part II* of this article we'll look at the causes of action saturation and discuss some ways of dealing with them in problematic actions. We'll also investigate some possible methods of increasing the efficiency of existing piano actions and consider the accompanying compromises.

Notes

1) "Assuming all else to be equal ..." Don't we writers love that little phrase, though. It allows us to make our assumptions and proceed right on with our conclusions and theories just as if those assumptions were tested and proven even if they are not — indeed they may be completely invalid and totally off the wall, but please don't check too closely! It's the "all else" that isn't equal that is usually most bothersome. That being said, try to imagine two pianos that are identical in every aspect except for soundboard size ....

2) Well, it can be, though not necessarily in a positive manner. Beyond a certain optimum size, increasing the surface area of the soundboard may actually make it less efficient as a transducer and in so doing reduce the maximum potential power level of the piano. Making a soundboard larger than its optimum size also may make a piano somewhat more difficult to voice evenly.

3) Credit where credit is due department: I was introduced to the basic concepts of piano action saturation at a PTG convention during the late seventies by an instructor whose name has, unfortunately, faded into the ever-expanding gaps of my memory. Later, however, these ideas were developed and elaborated on by Lew Herwig in the bar of some — now also long forgotten — hotel well after most sensible folk had gone to bed. I was having a problem getting the power I wanted and expected out of some new grand pianos I was prepping and it was he who first encouraged me to investigate this phenomena and shared with me his thoughts on how to go about doing so. As usual, he was right. I have subsequently learned that at least two other manufacturers have done much more extensive work than I was able to do on the subject and arrived at generally similar conclusions. I don't know when or where the basic research was done, or who it was done by. I do know that the essential concepts of action saturation were understood at least by some in the early 1930s. Alas, as with many of the principles of good piano performance that were known and understood by piano builders and researchers in past decades, much seems to have been forgotten and/or is simply being ignored by many in our age of intellectual enlightenment.

4) In any given grand piano the key length is ultimately determined by the strike point of the hammer on the string at A1. Usually this is somewhere around 1/7.5 to 1/8.5 of the speaking length of the string. There are exceptions ranging from 1/5 (the Baldwin Model 6000 Upright) to 1/10 (some early European instruments). Key length in vertical pianos is limited only by the constraints of the case designer. The keys are sized to fit the style of the cabinet and are very often too short for good tactile feel.

5) These figures are the averages of a number of key strokes on a model action using a key height, width and length typical of one that would be found in a 6'- 1" to 6'- 3" grand. A special key was made for the tests. It was a straight and symmetrical key-shaped key like a typical "A" that would be found in the middle of the scale. For clarity the curves have been "smoothed" by a special curve-fitting routine that is part of the CAD program I used to create the actual graph printouts.

The pickups were simple lightweight electrical coils moving through a magnetic field. One small coil was epoxied to the hammer and another to the key just behind the head. The two signals from the coils were fed into a borrowed dual-trace storage oscilloscope. The scope was triggered by closing a circuit made up of a battery, some wire and two pieces of copper foil — one contact-cemented to the top of the key and the other one finger of the person striking the key — making a crude but effective switch. The instant his finger contacted the surface of the key, the circuit was closed and the scope was triggered.

The key was struck by hand using as consistent a blow as possible. I did put some effort into devising a striking mechanism for mechanically striking the key for a more consistent blow, but at the time I didn't have any material which would simulate the resilience of the human finger adequately and we got a lot of key bounce. Under the circumstances striking the key by hand seemed the most expedient solution.

While this was certainly not the most sophisticated test setup ever devised— and no attempt was made to calibrate any part of the system so one should not place too much reliance on the actual numbers, but the relative displacement vs. time relationships should be valid — I was able to get consistent enough results to demonstrate the phenomena of action saturation. At least to satisfy my own needs.

6) This assumes, of course, a hammer of relatively low density and high resiliency — as difficult to find these days as a politician of few words during an election year.

What Is Sound?

By Delwin D. Fandrich, RPT

Sound may be defined as any pressure variation that the human ear can detect and the brain can interpret as sound. All sound sources must have one thing in common — they must cause a change in air pressure. If pressure variations are repetitious and occur close enough together they will sound like a tone. The number of repetitions that occur each second is called the frequency of the tone and is measured in ***Hertz,*** or cycles per second. If a sound has only one frequency it is called a pure tone. Pure tones in nature are quite rare. Even when only one note sounds on a piano the waveform is fairly complex. A waveform consisting of a broad spectrum of frequencies occurring in random order is called noise. Though usually undesirable, noise can be useful. If the noise occurs in very brief spurts and in a controlled, coherent manner repeated regularly our ears might recognize the noise as a drum beat. It is our brain that ultimately identifies and judges air pressure variations as either noise or as useful and/or pleasant information.

Since the human ear cannot detect periodic pressure variations that take place fewer than about 20 times per second or more than about 20,000 times per second, the sound spectrum is usually defined as being from 20 Hz to 20,000 Hz. (This assumes a young person with very good hearing abilities — one whose ears have not yet been damaged by exposure to excessively loud and prolonged noises.) The frequency range for the piano is from 27.5 Hz to 4186.0 Hz, counting only the fundamental frequencies of A1 and C88 and assuming no tuning stretch.

A sound source — in our area of interest a vibrating piano soundboard that is repeatedly compressing and expanding the air molecules immediately adjacent to it — radiates power which results in a sound pressure. ***Sound pressure*** refers to the variations in air pressure that are caused by ***sound power*** being emitted from a sound source. Just as the electric element on a stove radiates power and heat is the result that is felt by the nerve sensors in our skin, the vibrating piano soundboard radiates power (sound power) and the variations in air pressure (sound pressure) are the result that is detected by our ears and interpreted by our brains as sound.

Sound power is measured in watts and is the rate at which energy is radiated from a source — it is some amount of energy per unit of time. Sound power is a scalar quantity in that it does not take into consideration any direction of energy flow. ***Sound intensity*** describes the *rate of sound energy past a specific point or through a unit area* and is measured in watts per meter squared. Sound intensity is a vector quantity and does consider the direction of the energy flow.

The level of the sound that we hear — the sound intensity — is dependent on how close we are to the piano, the power source; and on the acoustic environment — the sound field — in which we and the piano are located. The sound field is affected by the volume and shape of the room and the absorbency of its surfaces — especially those immediately around the piano. What we hear — the sounds our ears actually detect — is a complex combination of direct and reflected sound pressure which arrives at our ears at different times and from different locations.

Measuring Sound Power

By Delwin D. Fandrich, RPT

The smallest, or weakest, variation in sound pressure that a person with good hearing can detect has an amplitude of approximately 0.000020 **Pascals** (20 **Pa**). The pascal is a unit of pressure. One pascal equals 1.0 newton/meter^2 (or 0.0001450377 pounds/inch^2). This is about 5,000,000,000 times less than normal atmospheric pressure. A pressure change of 20 Pa causes the eardrum to deflect a distance of less than the diameter of a single hydrogen atom. At the other end of the spectrum, the human ear can tolerate sound pressures of more than a million times higher than this. If sound pressure were measured in Pascals the numbers would be quite large so a more practical system has been developed — the **decibel** (or **dB**) scale.

The decibel is not an absolute unit of measurement, but a ratio between a measured quantity and some agreed upon reference level. The ***sound pressure level (SPL)*** scale is measured in dB and is logarithmic. Besides being a more convenient way of expressing the amplitude of sound pressure fluctuations, a logarithmic scale also comes fairly close to approximating the human perception of relative loudness since the subjective response of the human ear is more nearly logarithmic than it is linear. The SPL scale uses the acoustic pressure at the threshold of hearing (20 Pa) as the reference level. This level is called p0 and is defined as 0 dB. The **SPL** for an acoustical pressure *(p)* is defined as ***SPL* = 20 log10 (*p*/ *p*0)**, measured in dB above the reference level p0. If an acoustic pressure (p) is quantified in Pascals and is multiplied by 10, 20 dB is added to the dB level. So multiplying 20 Pa by 10 equals 200 Pa or 20 dB (referenced to 20 Pa). Multiplying 200 Pa by 10 equals 2,000 Pa which corresponds to 40 dB. Following this a bit further we find that the dB scale compresses a range of a 1,000,000 Pa into a range of only 120 dB.

With the threshold of hearing defined as 0.0 dB we find that the threshold of pain for the average person is somewhere between 130 and 140 dB. Sound pressures — whether they're called noise or "music" — at or above this level will cause actual physical pain. It does not require sound pressures this high to cause permanent hearing damage, however. Sound pressure levels that can cause permanent damage vary with frequency and exposure time — and the exposure time is cumulative. That is, a temporary exposure to sound pressure levels in the 90 to 100 dB range may not cause *noticeable* hearing damage for a while, but some damage to the "hair-cell" of the inner ear will have taken place. Repeated exposure will increase this damage until suddenly one day you will realize that you simply can't hear as well as you once could. By then, of course, it's much too late to anything about it except visit your local hearing aid specialist. ***Any*** sound pressure level above 90 dB — about the level of sound put out by a typical large truck passing by on the street — should be avoided without some form of hearing protection.

A piano producing a sound pressure level of 80 dB at a distance of 1 meter (a little more than 3 feet) from the soundboard will be radiating approximately 1 mw of power.

Tuning the Small Piano

By Bill Clayton, RPT
Charlotte, NC Chapter

It happened again at the 1991 NC Conference. A very good three-hour class on temperament tuning was ending when a question was asked concerning how did the theory apply to small pianos. The instructor was polite in sidestepping the question ending with the comment that "... some pianos can't be tuned."

I can remember my first encounter with a nationally known, factory-sponsored instructor when I asked a similar question. His response was, "I don't work on junk."

Those of us who principally tune for a living, have to tune a lot of "junk." I would guess that at least 90 percent of us have these "junk" pianos as over 50 percent of our business.

While there are some pianos I don't like, I have never come across a piano that, if mechanically and structurally sound, was untunable.

The easiest pianos to tune are those whose scaling conforms to an Ideally Sequenced Inharmonic Pattern (ISIP). I'll call these "ISIP" pianos. These pianos are generally concert quality instruments and the checks for octaves, thirds, fourths, fifths, etc., all work reasonably well. The rules of ISIP apply to them.

Then there are pianos that do not conform to the rules of ISIP. These pianos are more difficult to tune because the inharmonic pattern they emit is not in an ideal sequence. But, these pianos are tunable. From a tuning point of view only, maybe the people who call them junk, or untunable, haven't developed the necessary skills to deal with them.

I would like to share with you a few simple tuning procedures which seem to work on small pianos.

But first, some priorities for various intervals should be set. I have found that a priority system which follows the basic harmonic pattern of strings works best. So, highest priority is given to the 1:1 relationship, or the unison. Then the 2:1, 3:2, 4:3, 5:4 follow in descending order of importance.

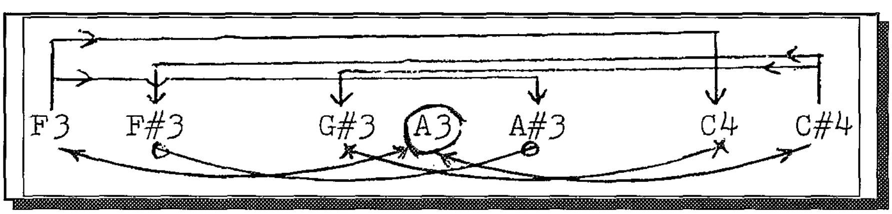
These correspond to the octave, fifth, fourth, and third, the primary intervals we use in setting a temperament.

So anytime we are setting a temperament we give top priority to good clean, but stretched, octaves, then good fifths, then good fourths, and if possible, good ascending or descending thirds. However, we should not sacrifice a fourth or fifth to keep a third in order. Instead we properly temper our fourths and fifths and let the thirds be a little out of sequence if the inharmonicity of the piano so dictates.

Next, any system used to tune a small piano must also work on concert quality pianos. The reverse is not always true.

With more than 3,000 of us tuning on a daily basis, there may exist more than 3,000 correct, and different, ways to do the same job. So, the following temperament is not the only way, just a good way that works for me. With practice it will work for any aural tuner with RPT abilities. This temperament requires the user to have good aural skills in the area of tuning tempered P4ths and P5ths, and good guessing skills in tuning M3rds.

Start by establishing A=440. Then tune A3. From A3 tune F3 and C#4 making your best guess. Then from F3 tune up a P4th and P5th, properly tempered of course. Then from C#4 tune down a P4th and P5th. You will now have the following notes tuned (below):



You have now created paired M3rds to the F3-A3-C#4 thirds you guessed at, with the F#3-A#3 and G#3-C4 M3rds. Check the paired M3rds for proper sequence. If you can tune your P4ths and P5ths accurately, then this system of seven notes will fit together *only one way* for any given piano.

If there is an error in the paired thirds then change the F3 and/or C#4 and the P4ths and P5th tuned from them until you get the proper progression of thirds.

From A3 you can also tune up a P4th and P5th. The resulting D4 can serve as an early, or additional, A#3-D4 M3rd check.

The D#4 will fit between the G#3 and A#3. A good check at this point is to make one interval pure and see if the other beats about twice as fast as it should. Then split the difference, 60 percent of the beat to the P4th and 40 percent to the P5th.

The final test of accuracy is to set G3 from C4 and D4 and to set B3 between F#3 and E4. Then check the G3-B3 3rd. It should progress with either the G#3-C4 or F#3-A#3 thirds, maybe both, but not necessarily both. There you have a temperament, twelve notes, without an octave. Continue by tuning octaves, refining the octaves with fourths and fifths.

Now, the "caveat emptor" conditions. An essential element in the success of this sequence is that the F3 and F#3 have the same type of wire, such as both bichord wound, and that the G#3, A3, and A#3 have the same type of wire, such as trichord steel. (Note that the F3 and A3 do not have to have the same type wire). This is to insure the first M3rds you check will progress properly. Most console and spinet pianos will cooperate nicely on this condition.

Following is a chart showing some of the more common scaling patterns. (See Figure 1).

Some general inharmonic rules that apply to most strings in small pianos are:

1. For a given type of string, the lower in the scale the lower the inharmonicity.

2. In octave three, a wound string will have a substantially lower inharmonicity than a steel string.

3. Bichord steel strings usually have a much higher inharmonicity than their trichord steel neighbors.

4. The shorter the string the higher the inharmonicity.

Anyone who has taken the PTG tuning exam will probably remember the nice ascending and descending major thirds when the test piano is detuned. This is a good example of how a piano can be forced into a preconceived mold without being in good tune.

However, a predictable order in the progression of major thirds is a valid objective in a well tuned piano. But, it must not be an overriding factor while tuning.

From the scaling examples in Figure

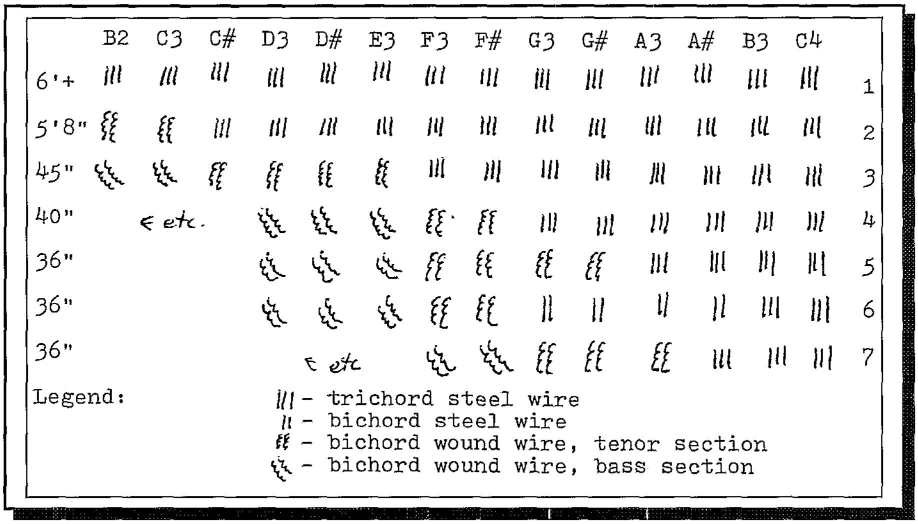


Figure 1

1 the progression of major thirds does follow a predictable pattern, but not a perfectly smooth pattern, as seen in Figure 2.

Figure 2 usually has lower inharmonicity from C4 up and perhaps a little higher than average from C4 down to the last note on the bridge, probably F3.

Lower note of major third and beats per second.

C3	C#	D3	D#	E3	F3	F#	G3	G#	A3	A#	B3	C4	
5.2	5.5	5.9	6.2	6.6	7.0	7.5	8.0	8.5	9.0	9.5	10	10.5	1
5.1	5.3	5.7	6.2	6.6	7.0	7.5	8.0	8.5	9.0	9.5	10	10.5	2
5.1	6.0	6.5	6.9	7.5	6.5	7.2	7.9	8.5	9.0	9.5	10	10.5	3
5.2	5.5	6.0	6.8	7.3	7.5	8.0	7.5	8.3	8.9	9.5	10	10.5	4
5.2	5.5	6.0	6.2	6.6	7.8	8.4	9.0	9.0	8.5	9.2	9.8	10.5	5
5.2	5.5	6.0	7.5	8.0	8.5	9.0	6.5	7.0	7.5	8.0	9.2	10.0	6
5.2	5.5	6.0	6.2	6.6	7.0	8.0	8.5	9.0	9.5	8.5	9.2	10.0	7

Figure 2

Generally, if the lower note of a M3rd is higher than normal in inharmonicity, then the M3rd will beat slower than expected. If the upper note is higher, the M3rd will beat faster.

Another condition of small pianos which influences inharmonicity is tenor bridge design. Generally the inharmonic pattern tends to follow the bridge design when no other factors are present. See Figure 3.

Figure 3 can be better or worse than the first two depending on the scaling. With wound strings on the short bridge the drop in inharmonicity is softened. But with bichord steel wire on the short bridge, as I have seen, harmonic disaster is the result.

So, how can one predict how a tuning should turn out on a small piano? You can get a good clue from looking at the shape of the bridge and the type of

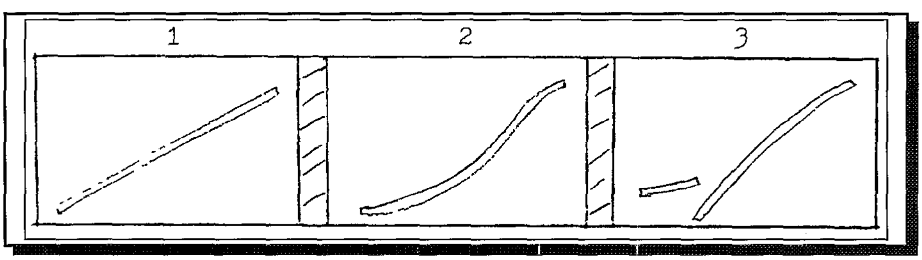


Figure 3

Figure 1 usually has high inharmonicity throughout the scale. But with no abrupt changes in the bridge the inharmonicity changes at a steady pace — a plus for tunability, even though it might have an F4 stretch number of nine or ten.

wire used in the various temperament sections. Tuning a small piano is a combination of understanding where it should tune according to the rules of ISIP and understanding where it is going to tune due to its mix of string type, string length and bridge design.

Appendix

Visual aid instructions for tuning small pianos.

1. Determine a good stretch number for the piano according to the visual aid program.
2. Start tuning from C5 and work down to C4. Listen to the C4-C5 octave. If it is not clean then the visual aid should not be used for the piano (or go back to #1). If it is clean then proceed with #3. C4-C5 is your primary temperament octave.
3. Switch the visual aid out of its program mode into its tuning mode, so it shows the note and octave being read.
4. Set the aid to C5, play C5 and stop the lights.
5. Play C4. The lights should (must) rotate very slowly flat.
6. Lower the cents display 1.5¢ and play C4 again. The lights should *not* rotate flat. (They may rotate sharp) The stretch is within reason.
7. Set the aid to B4, stop the lights while playing B4, then aurally tune B3 to B4 and check with E4 and F#4. B3 should make the lights rotate very slowly flat, as in step 5.
8. Then set A#4 and tune A#3 as in step 7. Use the visual aid to tune 2:1 octaves slightly stretched from a maximum of 1.5¢ at C4-C5, to a maximum of 3¢ at the C3-C4 octave.

When you first try this method of tuning on a small piano avoid playing any M3rds until you have completed all notes C3 through C5.

Also, do *not* use any octave checks. Remember, this is a small piano and you cannot depend on the octave checks you normally use. A 6:3 or 4:2 may be narrow of a 2:1 on these pianos, particularly in octave three.

Just for fun, and maybe for knowledge, reengage the programmed tuning set in step 1, and compare the C3 through C4 actual readings to the programmed readings, but don't change any notes.

An Easy, Accurate Bearing Plan

By Daniel Ressl

Introduction

Setting the bearings should not be attacked as a puzzle. No guesswork has any place in its consideration. Accuracy here is of the highest importance, because the accuracy of the rest of the tuning depends upon the bearings.

Even though all pianos contain some degree of inharmonicity, which causes intervals to beat at speeds which vary to some extent from mathematically calculated beat rates, the following characteristics illustrate the desired objective:

1. Minor thirds, major thirds, major sixths, major tenths, and major seventeenths gradually and evenly increase in beat speeds, when played chromatically up the keyboard.

2. Fifths beat slowly on the narrow side. Narrow is verified by the major tenth - major sixth test of 3:2 fifths, or by the major third-minor third test of 6:4 fifths.

3. Fourths beat slowly on the wide side. Width is verified by the major third - major sixth test.

A tuner must listen at the correct coincident partial level for each beat rate. For example 6:4 fifths and 3:2 fifths beat differently. That is why every coincident partial will be specified, in parentheses, following each interval. For example: E44A49 (E68) means that E68 is the coincident partial for tempering the fourth E44A49. Quietly playing the note in parentheses, prior to playing the interval, helps the ears to focus on the desired partial.

In brief, beats in intervals arise when partials coincide, and re-inforce each other's sound waves so many times per second. The partial series of C28 is: partial one C28, two C40, three G47, four C52, five E56, six G59, seven B-flat 62, eight C64, nine D66, ten E68. The partial series above any tone follows the same pattern, that is, octave, octave-fifth, double octave, and so on.

Two New Bearing Plans

For an initial overview, observe that the tuning order is identical in both of these bearing plans. A,E,B,E; D,G,D,C; F-sharp, C-sharp, G-sharp, D-sharp, A-sharp, and F follows the circle of fifths from A first in one direction to E and B; then in the other direction to D,G and C; and finally in the original direction from A,E,B to F-sharp etc. to F.

The first bearing plan covers the A37-to-A49 octave, and consists of fourths and fifths, checked by a few of the easier-to-hear major thirds and major sixths. It is suitable for novice tuners, with strong emphasis on tempering fourths and fifths, at least well enough to close the circle of fifths. The high range makes faster-beating fourths and fifths a little easier to hear and control, reduces confusion between 3:2 and 6:4 fifths, and avoids wound strings.

The first bearing plan prepares for the challenges of the second bearing plan, which balances faster-beating thirds and sixths with slower fifths and fourths, to efficiently attain the objectives listed above, numbered one to four. Down in the octave from E32 to E44, thirds and sixths slow enough to control better.

Calculation shows that these bearing plans contain a remarkably low theoretical deviation of less than one tenth of one cent. This was established by calculating partial frequencies for each tone according to bearing plan directions, then determining cents values, correct to thousandths of a cent, for each tone.

In both bearing plans, after the initial fifths and fourths are tempered by 3 bps and 2 bps, the piano automatically furnishes all other fourth and fifth beat rates, by an easy system of setting speeds halfway between two previously established beat rates.

Of course, 3 bps and 2 bps can be precisely counted as triplets and couplets per second, against a metronome or wrist watch. There is no guess work. The degree of accuracy achieved here depends solely on how precisely you work.

The First Bearing Plan, A37 to A49

1. A49. Tune A49 in unison with an A=440 tuning fork. Test F21 and the fork beats at the same speed as F21A49 (A49), (the coincident partial is in parentheses)

2. A37. Tune the octave A37A49 (A61) pure. Test A37D42 (A61) beats at the same speed as D42A49 (A61). Test F33A37 (A61) beats at the same speed as F33A49 (A61).

3. E44. Temper E44A49 (E68) 3 bps wide. Test C40E44 (E68) beats slower than C40A49 (E68). This E44 will be retuned.

4. B39. Tune B39E44 (B63) pure. Test G35B39 (B63) beats the same speed as G35E44 (B63).

5. E44. Temper E44A49 (E68) 1.5 bps wide, every second count of three per second. Test C40E44 (E68) slower than C40A49 (E68). Test A37E44 (E56) slower than B39E44 (B63) slower than E44A49 (E68). Test C28E44 (E56) slower than C28A37 (E56); and G35B39 (B63) slower than G35E44 (B63).

6. D42. Temper D42A49 (A61) 2 bps narrow. Test F33A49 (A61) slower than F33D42 (A61). This D42 will be retuned.

7. G47. Tune D42G47 (D66) pure. Test B-flat 38,D42 (D66) beats the same as B-flat 38, G47 (D66).

8. D42. Temper D42A49 (A61) 1 bps, every second count of two per second, narrow. Test F333A49 (A61) slower than F33D42 (A61). Test A37E44 (E56) slower than D42A49 (A61), slower than B39E44 (B63), slower than D42G47 (D66), slower than E44A49 (E68). Test B-flat 38 D42 (D66), slower than B-flat 38, G47 (D66).

9. C40. Tune C40 G47 (G59) nearly pure, then raise C40 so that the narrow fifth C40G47 (G59) beats halfway in speed between A37E44 (E56) and D42A49 (A61). Test E-flat 31,G47 (G59) slower than E-flat 31, C40 (G59). Check C40E44 (E68) near 10.5 bps.

10. F-sharp 46. Tune B39 F-sharp 46 (F-sharp 58) nearly pure, then lower F-sharp 46 so that the narrow fifth B39, F-sharp 46 (F-sharp 58) beats halfway in speed between A37E44 (E56) and C40G47 (G59). Test D30, F-sharp 46 (F-sharp 58) slower than D30B39 (F-sharp 58). Check A37, F-sharp 46 (C-sharp 65) 10 bps, C40E44 (E68) 10.5.

11. C-sharp 41. Tune C-sharp 41, F-sharp 46 (C-sharp 65) nearly pure, then lower C-sharp 41 so that the wide fourth C-sharp 41, F-sharp 46 (C-sharp 65) beats halfway in speed between B39E44 (B63) and D42G47 (D66). Test A37 C-sharp 41 (C-sharp 65) 9 bps, A37, f-sharp 46 (C-sharp 65) 10.

12. G-sharp 48. Tune C-sharp 41, G-sharp 48 (G-sharp 60) nearly pure, then lower G-sharp 48 so that the narrow fifth C-sharp 41, G-sharp 48 (G-sharp 60) beats halfway in speed between C40G47 (G59) and D42A49 (A61). Test E32 G-sharp 48 (G-sharp 60) slower than E32 C-sharp 41 (G-sharp

60). Check C40E44 (E68) 10.5, B39 G-sharp 48 (D-sharp 67) 11, C40 A49 (E68) 12 bps.

13. D-sharp 43. Temper the wide fourth D-sharp 43, G-sharp 48 (D-sharp 67) halfway in speed between D42G47 (D66) and E44A49 (E68). Test B39 D-sharp 43 slower than B39 G-sharp 48 (D-sharp 67). Check A37 C-sharp (C-sharp 65) 9, B39 D-sharp 43 (D-sharp 67) 10, C40E44 (E68) 10.5. B39 D-sharp 43 (D-sharp 67) 10, A37 F-sharp 46 (C-sharp 65) 10.

14. A-sharp 38. Temper the wide fourth A-sharp 38, D-sharp 43 (A-sharp 62) halfway in speed between A37D42 (A61) and B39E44 (B63). Test F-sharp 34, A-sharp 38 (A-sharp 62) slower than F-sharp 34, D-sharp 43, (A-sharp 62). Check A37 C-sharp 41 (C-sharp 65) 9 bps, B-flat 38D42 (D66) 9 1/2, B39 D-sharp 43 (D-sharp 67) 10 bps.

15. F45. Temper the narrow fifth B-flat 38 F45 (F57) halfway in speed between A37 E44 (E56) and B39 F-sharp 46 (F-sharp 58). Test D-flat 29 F45 (F57) slower than D-flat 29, B-flat 38 (F57). Balance that F45 with the F45 required by C40F45 (C64), a wide fourth, beating halfway in speed between B39E44 (B63) and C-sharp 41, F-sharp 46 (C-sharp 65). Test A-flat 36 C40 (C64) slower than A-flat 36 F45 (C64). Searching for possible corrections or improvements, check the gradual and even acceleration in beat speeds of: A37E44 (E56), B-flat 38 F45 (F57), B39 F-sharp 46 (F-sharp 58), C40G47 (G59), C-sharp 41 G-sharp 48 (G-sharp 60), D42A49 (A61), A-sharp 38 D-sharp 43 (A-sharp 62), B39E44 (B63), C40 F45 (C64) C-sharp 41, F-sharp 46 (C-sharp 65), D42G47 (D66) D-sharp 43, G-sharp 48 (D-sharp 67), E44 A49 (E68).

For a preliminary pitch raise, I strip mute the entire piano; proceed from the bearings up to C88, unison while removing the strip mute from C88 to A49, and pull in the bass last.

For tuning the piano, I strip mute from A49 down to the lowest bichord. After the bearings, I tune bass octaves, remove the strip mute, and unison up through the bearings. I unison the treble as I go. Using wedge mutes, only on the trichord being tuned, automatically double checks the previously set unisons during treble tuning.

The Second Bearing Plan, E32 to E44

1. A49. Tune A49 in unison with an A=440 tuning fork. Test F21 and the fork beats at the same speed as F21A49 (A49) (the coincident partial is in parentheses.)

2. A37. Tune the octave A37A49 (A61) pure. Test A37D42 (A61) beats at the same speed as D42A49 (A61). Test F33A37 (A61) beats at the same speed as F33A49 (A61).

3. E44. Temper E44A49 (E68) 3 bps wide. Test C40E44 (E68) slower than C40A49 (E68). E44 will be retuned.

4. B39. Tune B39E44 (B63) pure. Test G35B39 (B63) beats at the same speed as G35E44 (B63).

5. E44. Temper E44A49 (E68) 1.5 bps wide, every second count of three per second. Test C40E44 (E68) slower than C40A49 (E68). Test A37E44 (E56) slower than B39E44 (B63) slower than E44 A49 (E68). Test C28E44 (E56) slower than C28A37 (E56); and G35B39 (B63) slower than G35E44 (B63).

6. E32. Tune the octave E32E44 (E56) pure. Test E32A37 (E56) beats the same as A37E44 (E56); and C28E32 (E56) beats the same as C28E44 (E56). Check E32B39 (B51) slower than A37E44 (E56). Test G23B39 (B51) slightly slower than G23E32 (B51).

7. D42. Temper D42A49 (A61) 2 bps narrow. Test F33A49 (A61) slower than F33D42 (A61). D42 will be retuned.

8. G35. Tune G35D42 (D54) pure. Test B-flat 26 D42 (D54) the same speed as B-flat 26 G35 (D54). Check G35B39 (B63) 8 bps, G35E44 (B63) 9, E32G35 (B63) 9.

9. D42. Temper D42A49 (A61) 1 bps narrow, every second count of 2 bps. Test F33A49 (A61) slower than F33D42 (A61). Check E32B39 (B51) slower than G35D42 (D54) slower than A37E44 (E54) slower than A37D42 (A61) slower than B39E44 (B63). Test B-flat 26D42 (D54) slower than B-flat 26 G35 (D54); and F33A37 (A61) slower than F33D42 (A61). Check E32G35 (B63) 9, B39D42 (F-sharp 70) 13 bps.

10. C40. Temper the wide fourth G35C40 (G59) halfway in speed between E32A37 (E56) and A37D42 (A61). Test E-flat 31 G35 (G59) slower than E-flat 31 C40 (G59). Check G35B39 (B63) 8, C40E44 (E68) 10.5 (3 beats of GB take the same time as 4 of CE.) E32G35 (B63) 9, A37C40 (E68) 12, B39D42 (F-sharp 70) 13, G35E44 (B63) 9, C40E44 (E68) 10.5, A37 C40 (E68) 12, B39D42 (F-sharp 70) 13.

11. F-sharp 34. Temper the wide fourth F-sharp 34 B39 (F-sharp 58) halfway in speed between E32A37 (E56) and G35C40 (G59). Test D30 F-sharp 34 (F-sharp 58) slower than D30B39 (F-sharp 58). Check E32G35 (B63) 9 bps, F-sharp 34A37 (C-sharp 65) 10, C40E44 (E68) 10.5.

12. C-sharp 41. Temper the narrow fifth F-sharp 34, C-sharp 41 (C-sharp 53) halfway in speed between E32B39 (B51) and G35D42 (D54). Test A25 C-sharp 41 (C-sharp 53) slower than A25 F-sharp 34 (C-sharp 53). Check E32 C-sharp 41 (G-sharp 60) 7.5 bps, G35B39 (B63) 8, A37 C-sharp 41 (C-sharp 65) 9, G35E44 (B63) 9. B39 D42 (F-sharp 70) 13, C-sharp 41E44 (G-sharp 72) 15 bps.

13. G-sharp 36. Temper the wide fourth G-sharp 36 C-sharp 41 (G-sharp 60) halfway in speed between G35C40 (G59) and A37D42 (A61). Test E32 G-sharp 36 (G-sharp 60) slower than E32 C-sharp 41 (G-sharp 60). Check G35B39 (B63) 8 bps, A-flat 36C40 (C64) 8.5, A37 C-sharp 41 (C-sharp 65) 9, F-sharp 34A37 (C-sharp 65) 10, G-sharp 36 B39 (D-sharp 67) 11, A37C40 (E68) 12.

14. D-sharp 43. Temper the narrow fifth G-sharp 36 D-sharp 43 (D-sharp 55) halfway in speed between G35D42 (D54) and A37E44 (E56). Test B27 D-sharp 43 (D-sharp 55) slower than B27 G-sharp 36 (D-sharp 55). Check E32 - C-sharp 41 (G-sharp 60) 7.5 bps, F-sharp 34, D-sharp 43 (A-sharp 62) 8.5, G35E44 (B63) 9. A 37C-sharp 41 (C-sharp 65) 9, B 39 D-sharp 43 (D-sharp 67) 10, C40E44 (E68) 10.5. B39D42 (F-sharp 70) 13, C40E-Flat 43 (G71) 14, C-sharp 41E44 (G-sharp 72) 15. A-flat 36 C40 (C64) 8.5, G-flat 34 E-flat 43 (B-flat 62) 8.5. B39 D-sharp 43 (D-sharp 67) 10, F-sharp 34A37 (C-sharp 65) 10.

15. A-sharp 38. Temper the wide fourth A-sharp 38 D-sharp 43 (A-sharp 62) halfway in speed between A37D42 (A61) and B39E44 (B63). Test F-sharp 34 A-sharp 38 (A-sharp 62) slower than F-sharp 34 D-sharp 43 (A-sharp 62). Check E32 G-sharp 36 (G-sharp 60) 6 1/2 bps, F-sharp 34, A-sharp 38 (a-sharp 62) 7 1/2, B35B39 (B63) 8, A37-C-sharp 41 (C-sharp 65) 9, B-flat 38 D42 (D66) 9 1/2, B39 D-sharp 43 (D-sharp 67) 10. F-sharp 34 A37 (C-sharp 65) 10, G35 B-flat 38 (D66) 10.5, G-sharp 36 B39 (D-sharp 67) 11, A37C40 (E68) 12, A-sharp 38 C-sharp 41 (F69) 12.5, B39D42 (F-sharp 70) 13. F-sharp 34 A-sharp 38 (A-sharp 62) 7 1/2, E32 C-sharp 41 (G-sharp 60) 7 1/2. C40E44 (E68) 10.5, G35 B-flat 38 (D66) 10.5.

16. F33. Temper the wide fourth F33 B-flat 38 (F57) halfway in speed between E32A37 (E56) and F-sharp 34B39 (F-sharp 58). Test D-flat 29F33 (F57) slower than D-flat 29 B-flat 38

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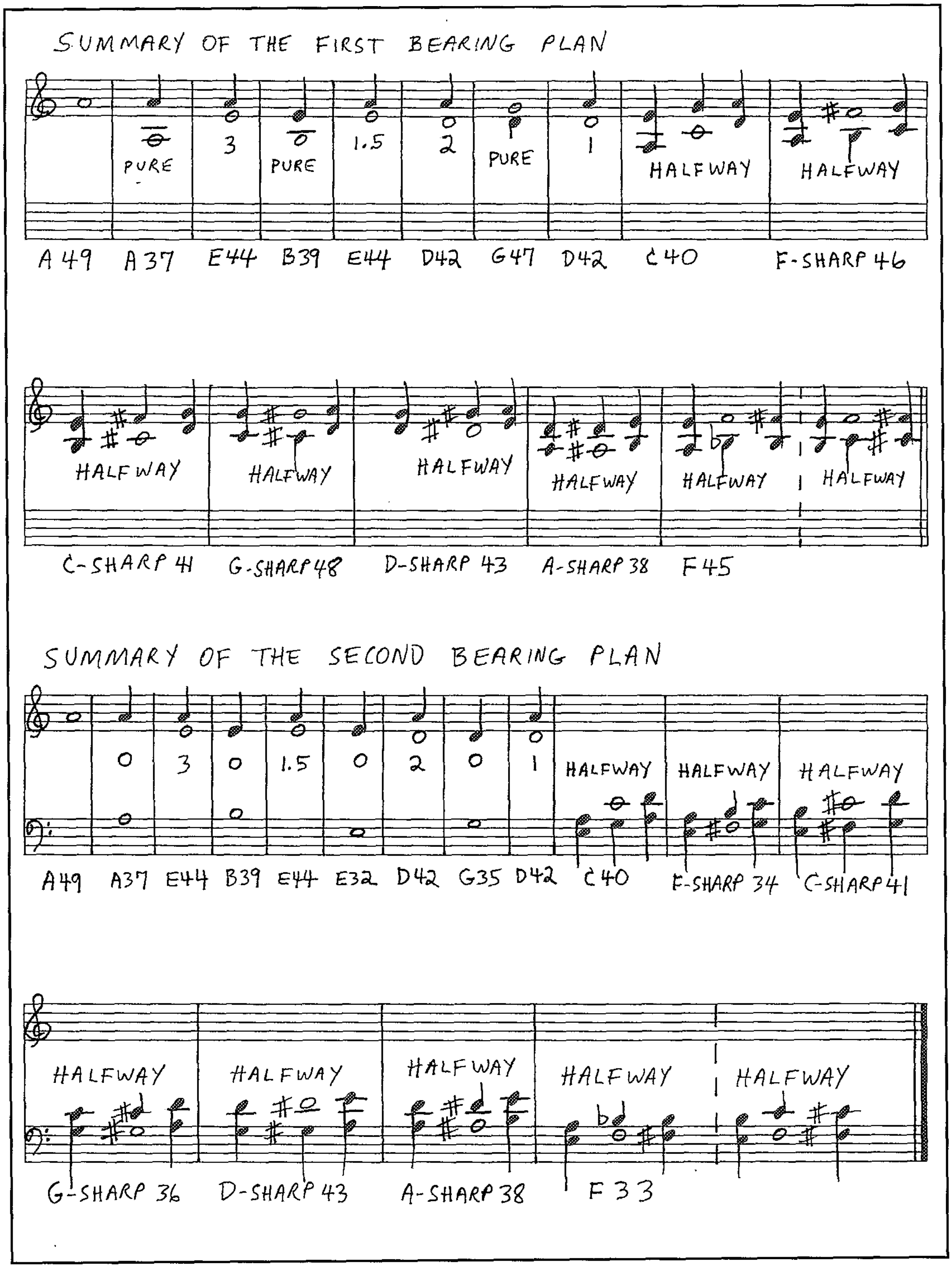
An Easy, Accurate Bearing Plan

Continued from Previous Page

(F57). Balance that F33 with the F33 required by the narrow fifth F33C40 (C52) beating halfway in speed between E32B39 (B51) and F-sharp 34 C-sharp 41 (C-sharp 53). Test A-flat 24 C40 (C52) slower than A-flat 24 F33 (C52). Searching for possible corrections or improvements, check the gradual and even increase in beat rates, playing chromatically up within the E32 to E44 octave, every fifth, E32B39 (B51), F33 C40 (C52) up to A37 E44 (E56); similarly all the fourths, minor thirds, major thirds, and major sixths. Check the equal beating pairs of inside major thirds - outside major sixths: F-sharp 34, A-sharp 38, E32 C-sharp 41 (G-sharp 60). G35B39 (B63), F33D42 (A61). A-flat 36 C40 (C64), G-flat 34, E-flat 43 (B-flat 62). A-37 C-sharp 41 (C-sharp 65), G35E44 (B63). Check the equal-beating pairs of major and minor thirds: A37 C-sharp 41 (C-sharp 65), E32G35 (B63). B-flat 38D42 (D66), F33 A-flat 36 (C64). B39 D-sharp 43 (D-sharp 67), F-sharp 34 A37 (C-sharp 65). C40E44 (E68), G35 B-flat 38 (D66).

As you complete the tuning by octaves and unisons, pursue the initial objective, that minor thirds, major thirds, major tenths, and major seventeenths gradually and evenly increase in beat speeds, when played chromatically up the keyboard.



An Adjustable Action Model

By Ted Sambell, RPT
Calgary Chapter

For some time considerable interest has been devoted to the subject of the geometry of the piano action, particularly the grand piano. Much valuable information has emerged; convention classes, chapter programs, *Journal* articles (compiled into a source book, *Hammers and Touchweight*) are contributing to a body of knowledge which is of more than academic interest, as anyone who has struggled with seemingly intractable action problems is well aware. Leverage ratios, friction lines, hammer weight and dimensions, and the like have engaged the attention of many of our leading technicians. I, for one, appreciate the glimmers of light gained in classes from Chris Robinson, Bill Spurlock and David Stanwood, as well as the discussions in our chapter.

The difficulties in solving action problems stem from their general inaccessibility and the fact that some measurements are almost impossible to change for experimental purposes; for instance, moving a key capstan screw forward or back, changing action spread and so forth, are not really practical methods of troubleshooting. If one modifies any of these during a repair, the die is inevitably cast, so one's predictions are something of a leap in the dark and had better be correct or suffer the consequences. Thus, it might be helpful to find a suitable means to *test* any changes *before* making them.

With this in mind my colleague at the Banff Centre for the Arts, Denis Brassard, and I decided to see if we could construct a single key action model with a broad range of adjustable features. The results of our efforts can be seen in the following photographs and descriptions.

1. Hammer Flange & Wippen Rails

These can be raised, lowered or moved horizontally left to right. Denis solved the problem of adjustment with pieces of aluminum angle, slotted for machine screws in the rails. This allows for action spread measurements and studying the effects of over and under striking (See Photos 1 and 2).

2. String Height

The piece of rod representing the string can be raised to accommodate any length of hammer.

3. Key

The capstan may be adjusted to center under any wippen heel and the balance rail can also be moved. As the front rail is not adjustable it was necessary to make the front mortise with a key bushing 3/4 in. (19 mm) in length as shown in Photo 3.

4. Backcheck

Adjustable fore-and-aft. The angle is set at 72 degrees.

5. Balance Rail

In addition, four different balance rail mounts are stored on a separate balance rail pin behind the key (See Photo 4) plus a key dip block, designed to go under the key by slotting it.

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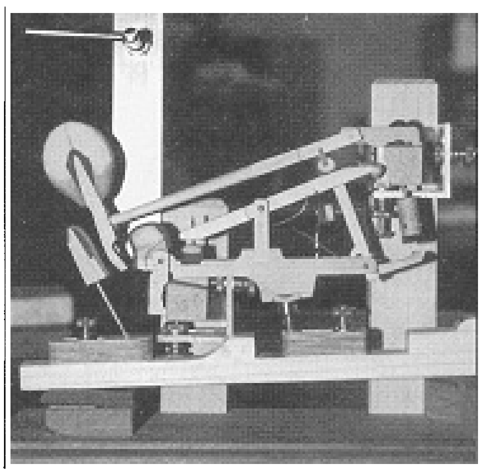

Photo 1

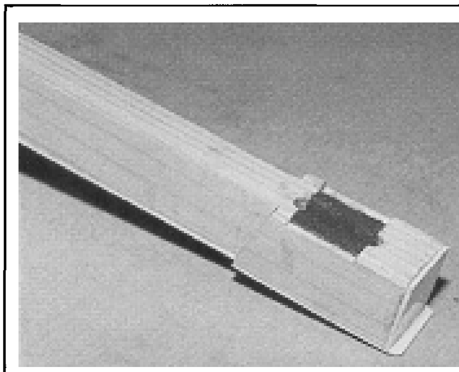

Photo 3

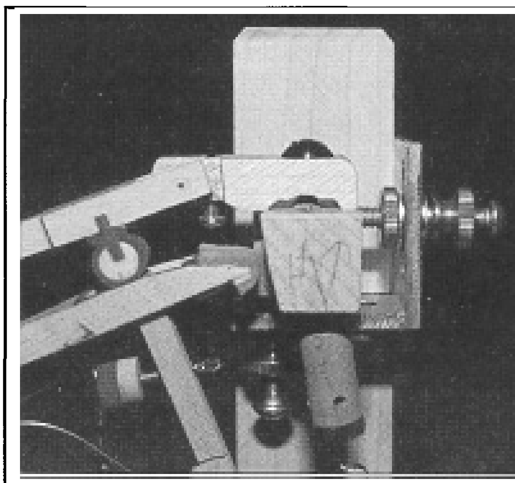

Photo 2

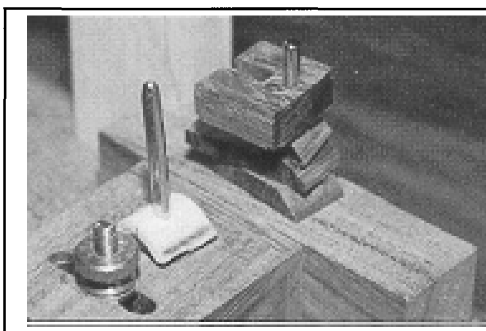

Photo 4

An Adjustable Action Model

Continued from Previous Page

The accompanying illustration shows the profiles of the mounts. No punchings are included. (See Figure 1)

The balance rail (a.) is unusual; I recollect an old Blüthner with something similar. The balance pin hole is bored at the peak of two bevels, which would require these to be bored first during manufacture before shaping the top of the rail. Rail (b.) is very common; the bevel does not reach the balance pin, which raises an interesting point. When the key is depressed the true fulcrum must be the front edge of the cloth punching and the key must tend to climb up the pin! In reality the movement is so small that we will be surprised to find any significant effect in our testing. With rail (c.) the bevel just meets the edge of the balance holes. With (d.) is shown the Steinway balance rail bearing. This design is interesting because it is obvious that as the key is depressed the fulcrum changes dynamically, shortening the front length while lengthening the back. Again, this movement is very small and may or may not prove to be significant. To check this a center line on both key and bearing have been marked at the mid point to the balance pin so as to observe any change when the key is moved.

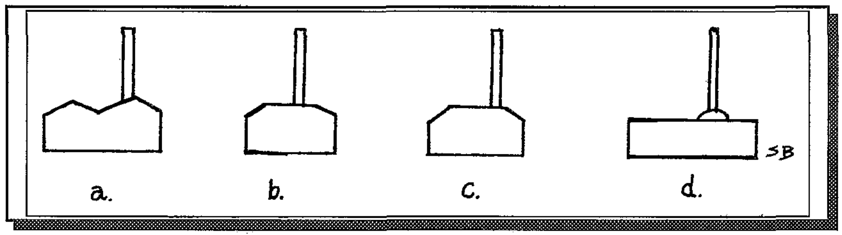

Figure 1

Applications

There are probably two main directions where this model can be applied: first, and perhaps most usefully, in searching out difficulties in problem pianos, as all measurements can be duplicated; secondly in researching the subtle nuances of such an elegant mechanism.

At this time it is too early to draw many conclusions; I can only say that having survived such an exercise I am more than ever filled with admiration for the people who pioneered and developed our modern grand piano action.

Behold The Upright

Let's Make a New Bass Bridge Before We Restring

By Don Valley, RPT, MM
Western Carolinas Chapter

Among frequent problems unique to the upright is an unglued or seriously deteriorated portion of the bass bridge unit. I call it a unit because it does not usually stand alone on the soundboard, but is usually in combination with an apron. The apron is not normally part of the problem, so you will find it necessary to repair the bridge cap, replace the bridge cap, or remake the complete bridge and attach it to the apron. I recommend completely remaking the bridge over repairing it. The task is not difficult and is little, if any, more time consuming than making extensive repairs. The integrity of the entire unit is certainly more predictable than if the old bridge is repaired.

How can I recognize a damaged bass bridge? The first indication is by sound; it will be very obvious if one part of the bridge unit has become detached from another. The sound approximates that of large snares on the bottom of a washtub! It may be just part of the bass section responding this way. It says you had better remove the entire bridge and secure it once again. Sometimes you will find the bridge is unglued from the apron but is still in good condition. In this case, it can simply be reattached just like the newly made bridge. The second way to tell is by sight. The most obvious problem is a split along the pin line; this kind of crack can allow the pins to shift position, thus compromising sidebearing (See Photo 1).

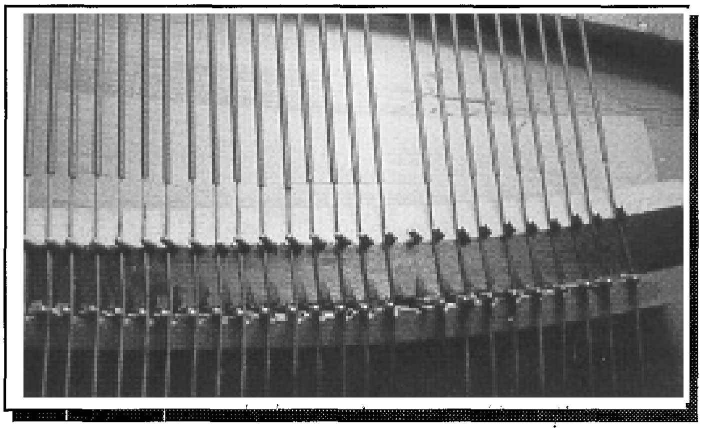

Photo 1

The bridge in this particular piano is an example of the latter case. It had not come unglued, but had developed a cavernous split (See Photo 2). This, of course, required replacement, not repair. As the repair process gets under way, you first must determine a way to get the bridge free from the apron. Prior to this be sure to collect any bridge pins that are loose or fallen out so they do not get dislodged in the piano and cause buzzes later on. Apply a chisel along the base of the bridge, striking it with moderately firm blows along the glue line. You are trying to break the glue seat so the bridge will release without ripping any wood away (See Photo 3). Be aware that often there are about three screws coming up into the bridge from under the apron. You will need to force the bridge off these screws. Once the bridge is free, remove any screws from the apron and scrape any remaining glue away. Now you are ready to begin the duplication task.

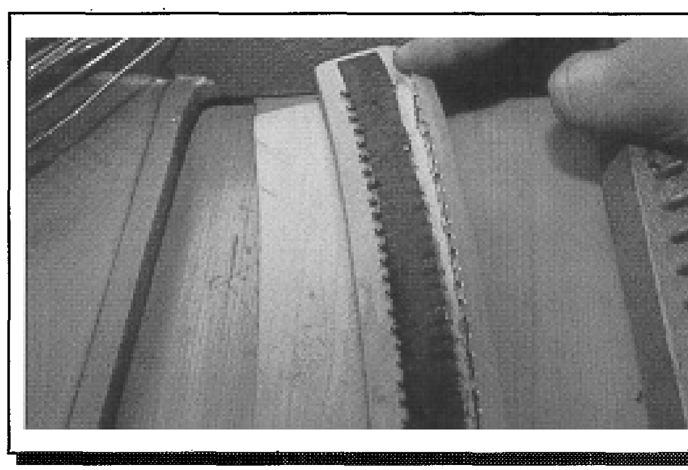

Photo 2

For purposes of expedition, and assuming this is a normal repair rather than a reconfiguring of the bridge unit, we will proceed with actual duplication. You have already determined there is sufficient downbearing. You will be duplicating

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not only the length, width and contour of the bridge, but the actual height as well. To verify the height, measure every

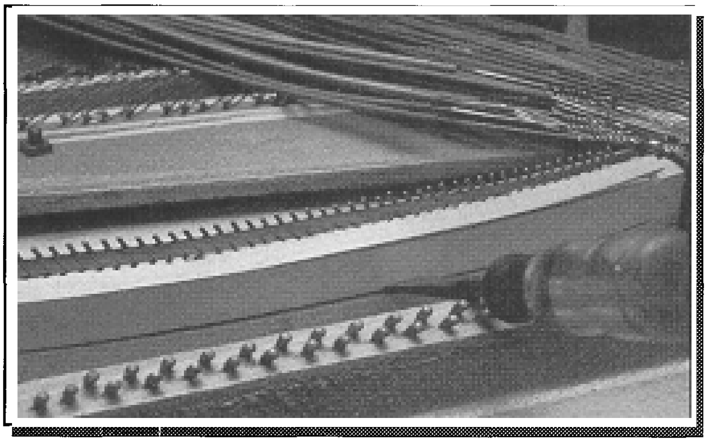

Photo 3

three inches along the bridge (See Photo 4). Many bridges have a taper from one end to the other in order to achieve proper downbearing throughout the section.

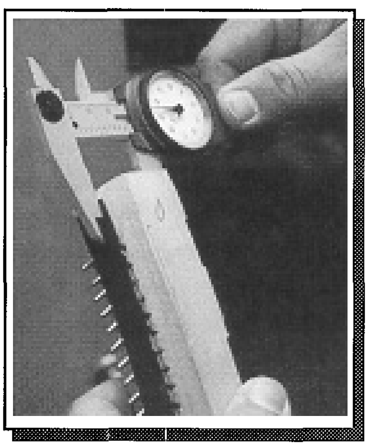

Photo 4

The stock I prefer for bridge-making is Delignit® pinblock material. I find the stability, density, and dependability of this product to give excellent long-lasting results, and it does not require the fabrication of a separate cap.

Before cutting a new blank, make a template of the old bridge by marking or punching the pinholes. A tracing film, such as Mylar®, is very useful. This can be purchased in craft and hobby stores. Any good sturdy plastic that is stiff enough to hold position would be satisfactory. Making the pattern is done by laying the film on the old bridge (See Photo 5). With a steel punch, mark each pin hole. Now keep this for transferring onto the new bridge.

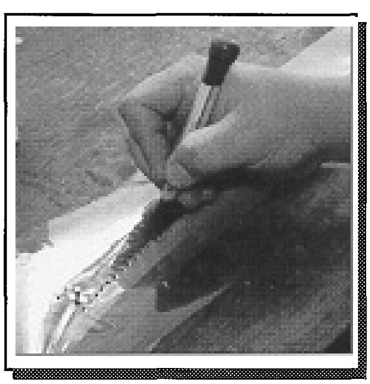

Photo 5

When you have a large split, the pin location cannot be determined from the original (See Photo 6). With clamps, secure the old bridge back onto the apron. Prepare a fine wire or string with a loop in one end, and pretend it is the piano string. Loop it on the bearing bar pin under the tuning pin; pull it straight across the bridge to the hitchpin. Using a fine-point permanent

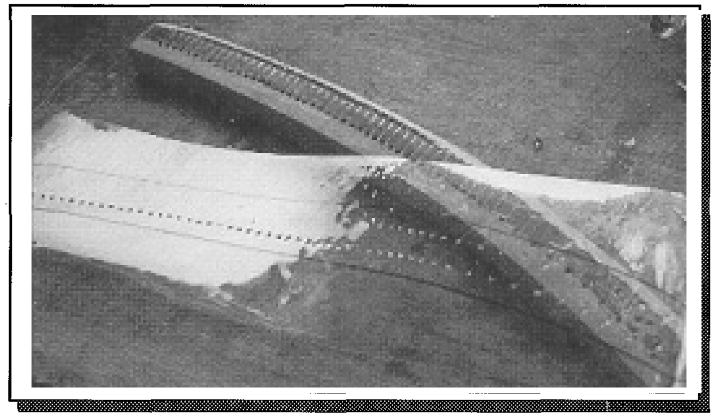

Photo 6

marking felt-tip pen, mark the pin location on the opposite side of the string (touching the string) from the other pin. For sidebearing, all you are doing is wrapping the piano string on opposite sides of two pins in a straight line but leaning in opposite directions. This is quite sufficient.

Trace a pattern of the bridge onto the new blank. If it is curved, cut it out on your band saw. If it is straight, a good table saw is best. Be certain your cut includes the pencil mark so your size is exact. Sand the sides and ends smooth. If there is a taper from end to end, take care of that, making sure the surface is perfectly flat. I prefer to taper the bottom side of laminated material for reasons of appearance. If the bridge is not a notched type, cut the bevel along the top

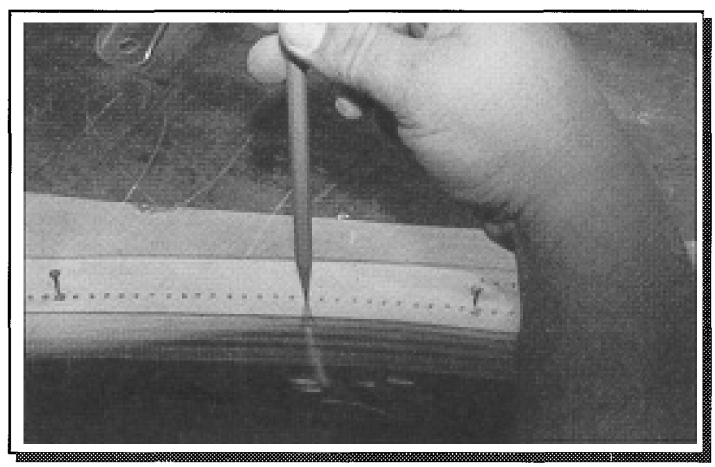

Photo 7

edges. A rough cut with band saw and final forming by filing and sanding is one way. Another is to use your router, if you have a tip suitable for this bevel. When you are satisfied that your bevel is smooth, apply Dag to the top surface. When it is dry—in a few minutes—burnish it well. This is the time to take your punched template and secure it to the top. Mark the bridge, preparing it for the drilling of the pin holes (See Photo 7).

Determine the angle of the bridge pin and set your drill press table at this angle or devise a jig for the table. Set your depth gauge to drill every hole the same depth, leaving about 5/16" of the pin exposed. A tight fit can be assured by choosing a drill bit .005 to .007 smaller than the pin you are using (See Photo 8). If you are using a hand drill, you can get a consistent angle by cutting a small block of wood to that angle. Set it at each pin mark and lay the drill bit against it as you drill the hole. You will need to mark your bit with a depth stop, also. You can get excellent results this way by being patient and working carefully. Do not attempt this job when you are in a hurry.

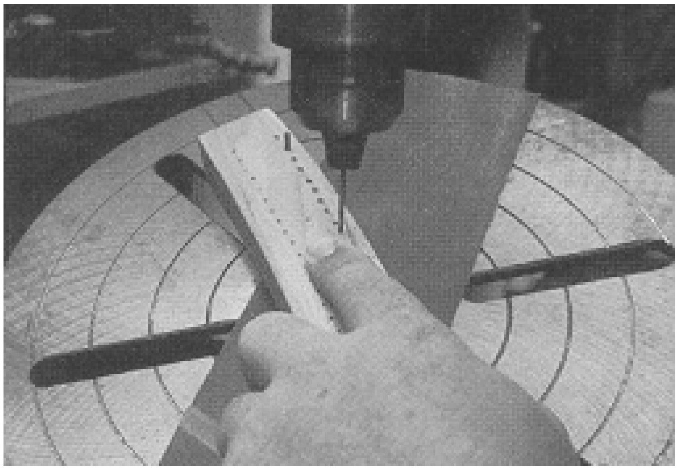

Photo 8

If your bridge is a notched type, this is the time to do the notching. Prior to doing your chisel cuts, cut the notch edges with a fine saw such as a Japanese pull saw. It is easier now than after it has been installed in the piano because of awkward positioning in the upright. For notching the bridge, your chisel must be extremely sharp. The sharper the chisel, the better the control. I recommend a double-beveled chisel especially designed for this work and one that is dedicated for bridge notching only. Be sure to start your cut at the center of the pin holes in order to insure proper string seating. Being careless here can bring on buzzing later. As you use your chisel, start as though you will make a moderately deep cut and proceed to bring the handle downward so as to produce a "scoop" or rounded cut.

Once your chiseling has been completed, you can prepare to glue the bridge back in place. Clamp the bridge to the apron and drill three holes through the bridge and into the apron. Countersink for flat-head screws so there can be no string contact with the screw. Unclamp the bridge and spread a thin coating of yellow wood glue on the bottom.

Reset the bridge in place and clamp it again. The reason for clamping is to eliminate any space created where the screw threads leave the bridge and enter the apron. Tighten the screws with all the power you can give them in order to squeeze as much glue out as possible. Another principle of joining woods is the less glue, the stronger — as long as the coverage is complete. If glue is like the filling in a sandwich, you have a very weak joint. The purpose is to have a wood-to-wood structure letting the fibers respond to the effect of the glue, knitting and bonding together.

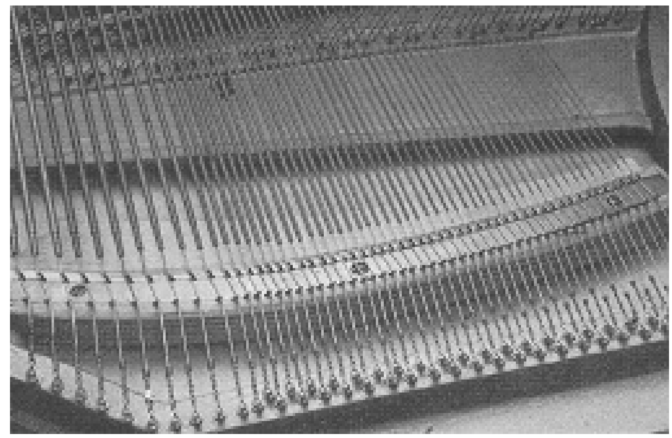

Photo 9

Restringing the piano is our next step in the rebuilding process (See Photo 9). The techniques of efficient restringing will be the subject of the next article.

In Brief

This lesson concludes the grand regulation steps with instructions on adjusting the shift or una corda pedal, the sostenuto pedal and mechanism, the hammer rail height and the key stop rail.

PACE

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LESSON PLAN

Technicial Lesson #35

Grand Regulation — Part 16: Adjustment of the Shift Pedal, Sostenuto, Hammer Rail & Key Stop Rail

By Bill Spurlock, RPT
Sacramento Valley Chapter

This montly 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.

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 good used pianos in a dealership are ideal. Action models are not suitable for this lesson.

Additional meeting setup should include:

- assortment of regulating tools
- hammer scrap felt for trapwork blocking
- flashlight

Estimated Lesson Time

Approximately one hour.

Tools & Materials Participants Must Bring

For this lesson, participants should obtain the following tools:

- two adjustable wrenches
- selection of general regulating tools

Assigned Prior Reading for Participants

PTG Technical Exam Source Book, pg. II.18 – II.2I

General Instructions

The Shift (Una Corda) Pedal

The shift pedal functions to alter the sound of the piano by shifting the action so only two strings are struck in the three string unisons, and only one or two in the bichord section. Volume will not necessarily change as much as the quality of the sound. Like all pedals, the shift pedal has one adjustment for the rest position (lost motion), and one for the end of its travel.

All hammers must first be evenly spaced to the strings, and the keyframe properly located on the keybed, to allow a consistent una corda function when the action is shifted. This procedure was described in Lessons #21 and 22. In addition, the keybed and keyframe surfaces must be clean, smooth, and very lightly lubricated with a small amount of talc or dry teflon. The keyframe guide pins, action return spring, and shift lever/keyframe contact point must also be clean and very lightly lubricated with a tiny amount of VJ lube or the equivalent. Finally, on certain designs, the keyblocks must be adjusted for the correct amount of hold-down force on the keyframe guide pins. This procedure is not covered in this lesson.

Lost motion: *There should be no lost motion in the shift pedal.* If the pedal rods have adjusting bolts as in Photo 1, adjust as necessary just until all lost motion is removed. The pedal must not prevent the action from returning fully to its rest position. If non-adjustable rods are used, add firm leather punchings under the pedal rod as needed.

Pedal travel: The action should shift only until the hammers clear the left string of three string unisons. Check many notes by depressing the shift pedal fully and playing a key while muting the right two strings as shown in Photo 2. Adjust the keyframe stop screw as necessary so that all hammers in the three string unisons clear the left string when shifted, but do not shift so far that they contact the adjacent unison. See illustration in Lesson #21.

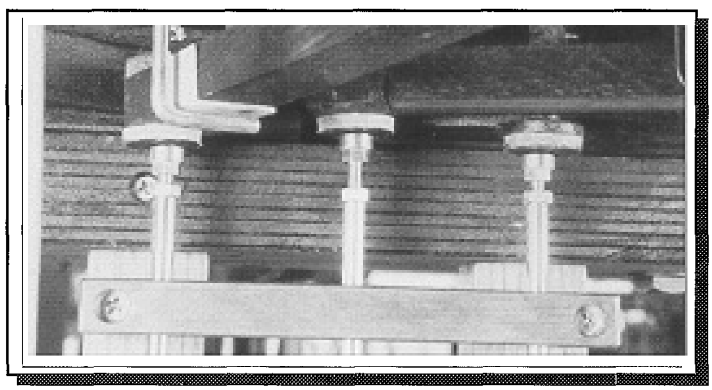

Photo 1 — Typical trapwork design having a screw adjustment for lost motion on top of the pedal rods.

Sostenuto

The sostenuto functions to sustain any dampers that are raised at the time the pedal is depressed. There are adjustments to the sostenuto blade as well as to the pedal and trapwork.

Sostenuto blade: Figure 1 shows the basic relationship of the blade to the sostenuto tabs in the rest and engaged positions. As with other damper adjustments, a straight line of damper levers, and hence sostenuto tabs, is necessary to proper functioning. If individual sostenuto tabs are significantly out of line even when the damper levers are in line, these can be adjusted by shimming or ironing the stop felt above the sostenuto tabs.

Blade adjustments are: height, in/out position, and blade rotation. These three adjustments are inter-related, and must all be close before a final check is made. Height and in/out position are adjusted via the blade mounting brackets. One common tates nearly to the 9:00 position. Adjust the pedal stop felt or capstan on the bottom of the keybed as needed.

Changing blade height will change blade rotation adjustments and vice versa. Therefore, all sostenuto blade and trapwork adjustments must be considered and refined in order to satisfy the following tests, illustrated in Photos 3, 4, and 5.

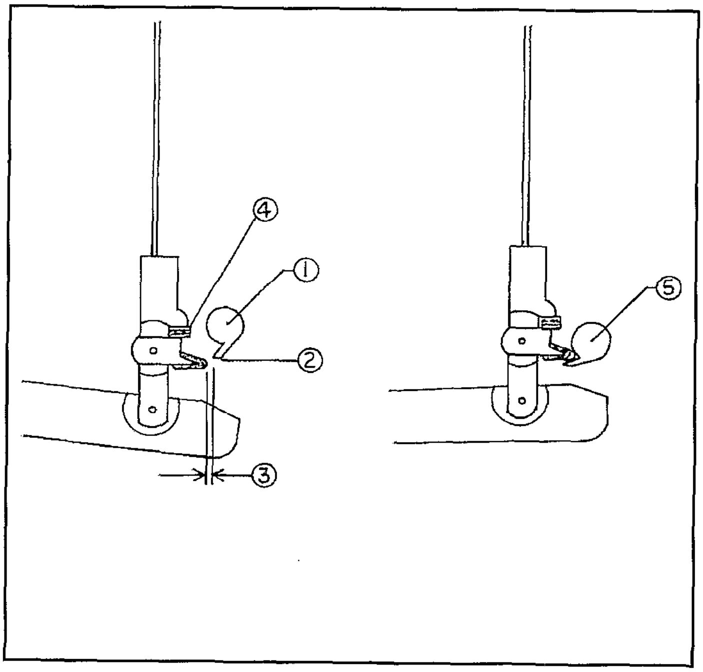

Figure 1 — sostenuto tabs and blade at rest (left) and engaged (right).
1) sostenuto blade in 7:00 position at rest
2) blade height at rest; bottom edge of blade in line with top surface of tabs
3) horizontal position at rest; approximately 1/16" clearance between tabs and blade.
4) tab stop felts
5) blade in rotated position

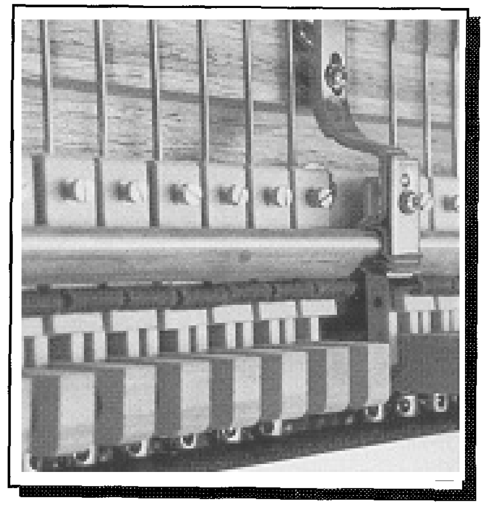

Photo 3 — Sostenuto test #1 — with the dampers at rest, the sostenuto blade should be able to rotate without contacting any of the tabs.

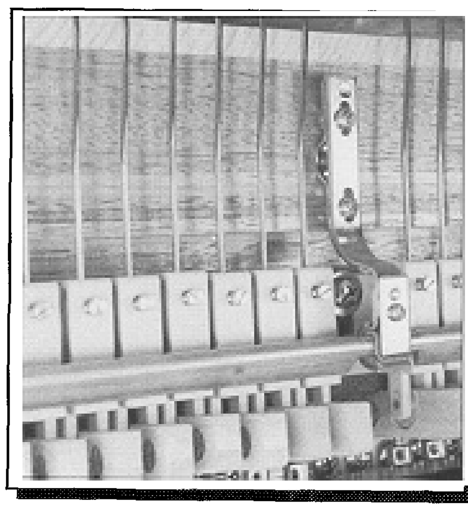

Photo 4 — Sostenuto test #2 — depress the sustain pedal, then the sostenuto pedal, then release the sustain pedal. All dampers should be held up by the sostenuto blade.

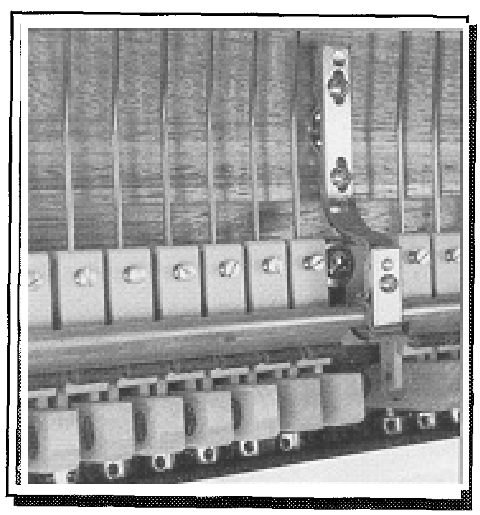

Photo 5 — Sostenuto test #3 — depress the sostenuto pedal, then the sustain pedal. No tabs should slip past the blade from below.

bracket system is shown in Photo 5. Slots allow vertical adjustment, while in/out adjustment is done by alternate loosening and tightening of the top and bottom bracket screws to "rock" the bracket in or out.

Blade height can be viewed (with the action removed) by looking in at eye level toward the blade. The top surfaces of the tabs should appear to be about even with the bottom edge of the blade.

Blade in/out position can be viewed by looking directly down through the strings (a flashlight is helpful). There should be approximately a 1/16" gap between the tip of the blade and the ends of the tabs.

Blade rotation is adjusted via trapwork adjustments as follows: Adjust the pedal rod so the blade is in the 6:30 to 7:00 position at rest, as shown in Figure 1. Depress the pedal fully and check that the blade ro-

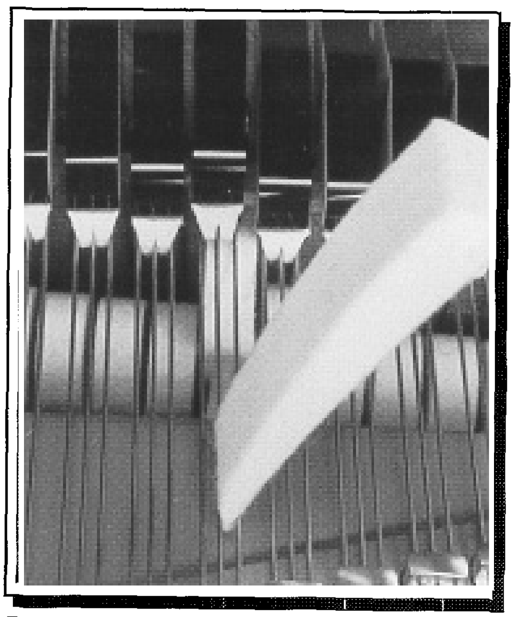

Photo 2 — Testing shift pedal travel by muting the right two unison strings, shifting the action, and checking that the hammer misses the left string.

Blade clears sostenuto tabs at rest: With all dampers at rest, the blade should be able to rotate through its full motion without contacting any tabs. With the action removed, depress

Continued on Next Page

Continued from Previous Page

the sostenuto pedal and observe. If the blade contacts any tabs, raise it higher or move it back from the tabs. See Photo 3.

Blade engages all tabs: Depress the sustain pedal to raise all dampers, then depress the sostenuto pedal. Release the sustain pedal and check that all dampers are reliably held by the sostenuto blade. If some are not, increase blade rotation, move the blade further in, or look at individual tabs to see if they are far out of line. See Photo 4.

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No tabs slip past blade from below: Depress the sostenuto pedal, then the sustain pedal. No tabs should slip past the blade as they are pressed against it by the damper lift rail. If any slip past, individual tabs may be too far in, the blade may not be rotating far enough, or the blade may be too far out from the tabs. This test can also be done with the action in place by depressing the sostenuto pedal and playing each key in the damper sections two or three hard blows.

Note: *Steinway damper systems have an action-mounted sostenuto rail requiring a slightly different adjustment procedure. For a detailed explanation of this, see the Steinway service manual.*

Hammer Rail

Some actions have an adjustable hammer rest rail, rather than individual hammer rest felts built into each wippen. In either case the names are misleading since the hammer shanks should never rest against them. The rest felts or rail should sit slightly below the shanks to act as a rebound cushion only.

After hammer blow distance is correctly adjusted, this rail should be set to approximately half a hammer shank thickness below the shanks. Check to make sure that it is high enough to avoid interfering with the wippen flanges, and make sure all its mounting screws are tight to avoid rattles.

Key Stop Rail

The key stop rail functions to prevent keys from lifting up off of the key pins when the action or piano are in transit. It must not be so low that it interferes with complete key return. This can be checked by seeing that keys can be lifted approximately 1/8" at the front before they contact the stop rail.

Exercises

Participants should evaluate the shift pedal lost motion and travel on a piano using the mute test shown in Photo 2, and should observe or participate in any correction to the adjustments. Each should perform the three tests for proper sostenuto function and also observe or participate in any correction.

Summary

This lesson completes the entire series of PACE Technical Lessons. Through these lessons, I have attempted to provide readers with an accurate understanding of not only some procedures involved in the work but the principles underlying the workings of piano actions and their parts. It is understanding the "why" and the "how" that really enables effective work in all situations.

While I have sought to present as many up-to-date and efficient methods of which I am aware, the great value of our organization is the opportunity it provides for building upon others' ideas and the continual advancement that we all enjoy as a result. In that light, I hope and fully expect that others will take this work further in the future. If some of this material can enable that process, I shall be extremely pleased.

A Prairie Home Piano Crash

Walter Sikora, RPT
Research Triangle, NC Chapter

"Yet I remember every face of every man who put me here" — *Bob Dylan*

I enjoy the hustle and bustle and all the commotion that comes with the moving trucks hauling in stagehands and equipment from some faraway place. Looks like it's going to be a really big show (or is that "shew?"). This is a new level of piano work for me. I spent ten years as a piano technician in Bloomington, Indiana, working mostly on Kimball consoles. Steinways were scarce in my niche in the market. Bloomington has the Indiana University School of Music. Their library has the complete collection of the *Journal.* That's how I got started. And two RPTs on Doug Strong's staff, Phil Sloffer and Ric Heeter, helped me get into the Guild.

I thought I was moving to Chapel Hill to change careers. I was burned out doing cheap school tunings and warranty work for dealers. I'd take my spare-time MLS degree from Indiana University and get a job as a college reference librarian.

Now it's a Friday afternoon, five years later. Just got home from tuning a nice old Chickering console in someone's laundry room. The hammer wear testifies that it gets played a lot. Going to rest a little before I head over to the University of North Carolina at 2 p.m. to tune the Steinway "D" for the "A Prairie Home Companion" show that's to be broadcast live on Saturday. The show is a sellout. Clark Ellis, the Production Services manager, has had to scramble to line up a Steinway to fulfill the terms of the contract. The show is on Memorial Day weekend. No concert Steinways are available to rent. Clark has had to arrange to have the Steinway at UNC's concert hall moved over to Carmichael Auditorium.

I get behind the wheel of my Windows 95/16 mega RAM turbo/28.8 bit hurler on a Pentium 90 block to check for voice mail. Little deuce coup, you don't know what I got! Caller ID has picked up a call from Clark.

"There's been an accident over here. The movers dropped the piano. They were short-handed so they recruited a desk jockey from the office. When it began to topple the two experienced guys bailed. The desk jockey tried a half second too long to stabilize it. He's got a broken leg. Wait until we call to come over here. We don't know what condition the piano is in or if they're going to be able to get it over here."

Around two o'clock I got the call. They had gotten it moved somehow. I throw a couple of tool boxes in the back of my beat-up '88 Camry wagon. At 2:20 I walk past endless crates of equipment marked "Minnesota Public Radio." Sound

The Tuner's Life

check is scheduled for 4 p.m. Normally all that would have been needed would be a fine tuning, a little voicing, and a check to make sure the trapwork is functioning properly. The Steinway had been kept within a few cents of A=440 for about nine months.

I had really enjoyed getting to know this piano. The last year or so I had prepared it for the North Carolina Symphony and Wynton Marsalis among others. Then when Itzhak Perlman and his daughter were booked for a concert, the head administrator was worried that the piano wouldn't be good enough. So I was paid to patch the cabinet, do a lot of hammer shaping and voicing, and tame a bunch of wild repetition lever springs.

Working with the Steinway has made me appreciate its unique sound. Especially the bass notes with their satisfying bite and timbre. Each note sounds infinitely deep and complex. An ordered and harmonious dance of ecstasy. Absolutely the best musical sound on the planet.

On a dark moonless night, looking at the galaxy cluster in the southwestern part of the constellation Virgo, I've seen upwards of a dozen gray blobs of light in the telescope's single eyepiece field of view. Each patch of light is a universe of stars similar to our own Milky Way. I like to imagine what might be going on in there. Probably some planets with pristine jungles and forests and dinosaurs. Planets with green oceans and alabaster cities. But everywhere in the universe will be found the inescapable gap between mathematics and musical aesthetics that the Ancient Greeks called "the comma." When the One, the Unity, exploded with the big bang, it fractured into the multiplicity we see today. Everything is a fraction of the One, and these fractions are just slightly incongruous with each other. That's why we have wars and equal temperament. The Steinway "D" magically masks this fundamental disharmony. I wonder if there are musical instruments in any of those galaxies as good as the Steinway "D."

So here's the familiar Steinway, the focal point of a stage crammed with equipment and hustling stagehands. The backdrop is a facade from an old Victorian style house with gingerbread trim. The stage floor is covered with a half dozen old, worn Oriental rugs. It's all very homey and charming. The lighting director shouts directions to a young woman perched about forty feet above the stage. She is aiming the lights and they flash in my face as I try to examine the wrecked piano. I can tell by her repartee she loves this job. She loves being part of this team.

"Sweet Honey in the Rock" starts rehearsing over the sound system. They sound marvelous, but there seems to be noise echoing and rattling and coming from everywhere. The lid of the Steinway has a long crack and there's a huge indentation in the top of the treble cheek where it apparently landed on its top. Otherwise, it looks reasonably intact. Thankfully, the plate looks OK. Plate bolts are tight. But I know there is probably a lot of subtle hidden damage.

Sure enough, a couple of the keys won't go down. Have to pull the action. Only place to put it is the floor. With my nose close to the floor I notice that cats have peed all over Garrison Keillor's beautiful old Oriental rugs. Better get something from the Kitty Boutique. Okay, the hammers move, wippens move. Have to pull the stack. Never done that on this piano. Looks like the key capstans have been lubricated with a combination of beef tallow and graphite! Unbelievable! No wonder the touch weight in the bass was so high. That problem was next on my list anyway. Need some Brasso®. Great! I happen to have some in my No. 2 kit. Just started packing it about a month ago. Do the guys buzzing around here notice how beautiful these polished key capstans are? In the stage lights the polished brass shines brighter than gold.

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A Prairie Home Piano Crash

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A string of eighty-eight golden pearls.

I've had my taste of other jobs. Got to teach "Introduction to Philosophy" once. It was so exciting I had to take a thermos full of Chamomile tea to class just to stay calm. The students probably thought I was sipping coffee to stay awake. Then there was the reference internship at Duke. It was a thrill when a black freshman student asked me for the tables from the U. S. Naval Observatory. She was calculating the orbit of Neptune. But the thing I always liked about piano work is the way it's so easy to slip into a zone of total concentration. The noise and chaos are still there, but they're in another compartment, along with Time. My mind is quiet and the seeing and the doing are of a piece. Plato talked about this sort of thing in The Republic. For Plato, a worker losing himself in his work was the ideal life.

Those stuck keys. Why won't they go down? I've seen piano wrecks bend the key pins, but these line up. Pull the keys out and there's the answer. Mangled key bushings. This one's quick and easy. Just clamp the felts back in place with a little Titebond. Meanwhile, it looks like the crash has dislodged all the dags and about three or four ounces of talcum powder in the keybed. It ain't mine. I use nothing but Spurlock's powdered Teflon® now. Clean this mess while the key felt dries. Zip up the stack, put the action back. All the notes play now. Well sort of. There's not enough lift on the dampers now and most of the notes are muted.

Thirty-five minutes left now till soundcheck. Put in the strip mutes. Turn on the Accu-tuner. This Steinway is memory #5. Thank you, Dr. Al Sanderson! Can't imagine trying to set an aural temperament in this din. A0 seems pretty flat. Even the Accu-tuner is having trouble picking up the partials in this noise. A#0, B0, C1. KAPOW!!! Oowww!! Broken string. It zings to the end of stage left. This is bad. The crash must have stressed the strings. "Someone find Clark and get him to send someone over with the replacement strings for the Steinway!" C#, D, D#, E. KAPOW!!! Arrrggh!!! Now it seems like bass strings are popping like popcorn. And each one is going to be a pain to replace. And I'm getting disoriented. Where is the pitch now on this thing anyway?! Is the Accu-tuner off? Is the piano really half a semitone flat? Or am I raising it a half-semitone sharp? I pull out a cheap pitchfork that I carry for this kind of emergency. I can barely hear it. Okay, the Accu-tuner is right. The fall has knocked the Steinway 50 cents flat. This is beginning to seem like the Apollo 13 of piano crashes.

Why am I doing this? I'm sweating like a prizefighter. I'm losing ground here. Why can't I tell them "sorry, but this piano can't be used for the show." Why do I feel like I have to do this? It's because I don't want them to lose faith in the piano. This nine-foot, nine-hundred-ninety pound, leg-breaking behemoth, hard to move, expensive to maintain. I'm surprised they still put up with it. It's up to me to try to make it up to them, to make it work, to make them keep believing that the sound and tradition of the piano are worth maintaining. Besides that, I need the money.

With trepidation I tune the next notes hoping that no more strings break. Luckily, none do. Soon I'm into the plain wire and I can relax a little. The Accu-Tuner is helping immensely, offsetting the pitch so it will settle back down close to standard. I'm zapping the strings up over 50 cents with a single flick of the tuning hammer, then letting them settle back to no more than a couple of tenths of a cent off. I feel like a Zen archer. I sure do enjoy my skill sometimes.

The pitch raise will have to suffice for the soundcheck. I tell them it will probably be ready by 4:30. The piano player, Richie, is concerned but patient and appreciative. So are the rest of the stage people. Race through the tuning. Most of the notes are still muted. Not enough damper lift. It's still a mystery to me. Makes it tough to tune. Richie will have to live with it for now. He's not very happy about it. He also doesn't like the heavy action in the bass and a couple of buzzing notes in the treble. I tell him "use a lot of pedal, I'll fix all this tomorrow."

A stagehand holds the bass strings in place on the hitch pins. Open my stringing toolbox. No stringing tools. Only ancient yellow envelopes of wire. Oh, that's right. Yesterday some physics students came by wanting to buy some piano wire for a science project. Usually it's the cheese cutter at the grocery store. Forgot to put the stringing tools back in there. Will have to get the job done with just the tuning hammer and a tiny pair of diagonal snippers. No insurance twist for these babies. Sometimes you have to violate the Guild's number one unwritten rule: never do anything shoddy. Stretch them with my thumb. Zap'em up to pitch with the Accu-tuner. Smooth out some octaves and unisons. Soundcheck sounds surprisingly musical. It's 4:45.

Clark meets me at 8 a.m. Saturday morning. Still got the same headache from last night. I have three hours to work. The impact has shifted the action toward the bass. Adjust the stop block. Gang sand the hammers with a wide strip of tape backed sandpaper to eliminate string grooves. Thanks, Nick Gravagne. Maybe I can get the dampers to lift by shimming up the backrail felt. This only makes the keys sag in front and doesn't help the dampers. Maybe the keybed has sunk. Turn down the glide bolts a quarter turn at a time. Then ease it back just enough so that adjacent hammers and keys don't bounce when a single note is struck hard. Thanks, Joe Bisceglie. Now the dampers work. Only a few have to be shimmed a bit under the damper lift felt. But now some of the dampers want to hang up on a hard blow. Adjust the damper stop rail. Lubricate all the knuckles with Spurlock's Teflon. Brush Protek® on the bass hammer bushings. Start retuning. Those buzzing notes? Check the seating of the strings at the bridge pins. Sure enough, there's a satisfying crunch as the strings reseat. So I do them all, and many repeat that satisfying crunch. Thanks, Wally Brooks. Now the touchweight in the bass is down to around 56 grams. Refit some of the hammers to the strings on notes that still don't ring true. Thanks, Ray Reuter. It's 11:30. Una corda's okay. Sostenuto's still a mess. Forget it. Time for another sound check.

Back at 4:30 for a final check and tuning. Pitch is still sinking. Clean up the unisons. Richie, the piano player, is nowhere around. But one of their guys comes by to say thanks for getting the piano ready under tough conditions. He says Richie is happy with it. It's 5:15. It is hot, and there is no air conditioning. Six-and-a-half thousand people are in the audience, waving the fans that have been handed out to them. I put the cabinet back together and decide to play my signature piece to test the piano. Always wanted to play for a big audience, especially when they can't hear me. The Steinway seems more responsive than ever. The sinews in my arms feel directly connected to the hammers. Must be the re-bedded keyframe. When I finish, it's obvious that no one has heard it. It's too noisy and the sound system isn't on. But the guitar player has been standing behind me. "That's a good one," he says. "What's the name of that?"

"The Chopin Etude No. 7 in A Major. My favorite piano piece." I don't mention that it is the only piano piece I know.

Then I'm off the stage. The band strikes up a lively number, the audience rocks and everything sounds normal. Garrison Keillor comes on stage and begins telling us and a nationwide audience about his perceptions of North Carolina as the piano tinkles in the background. They will never know.

Grand Illusions . . .
The Page for Serious Cases

Tuner-Technician Personality Inventory (TTPT)

Dear Readers: *This month, Mr. Piano Guy presents a special feature designed by MPG Enterprises staff psychologist Vinnie Libido. He has devised a personality inventory for you, the tuner-technician, to help you assess your suitability for this exalted profession and decide whether to continue your work or apply for a position at McDonald's. Answer the following questions carefully, score yourself at the end, and then make some career choices.*

Situation 1:

After the customer has let you in and shown you to the piano, she announces that she has to go to work and will leave you alone with a check for the tuning. After she leaves, you:

A) Spend extra time and do a superfine tuning, expecting her to be much more critical of your work since she wasn't around to watch you.

B) Whip through the tuning in 15 minutes, grab your check and leave, knowing that you'll have time for a couple of lattes before your next appointment.

C) Close up the piano, turn on the TV and watch Oprah and Geraldo for two hours before grabbing the check and leaving.

Situation 2:

As the customer lets you in the front door, the family schnauzer introduces himself by straddling your leg and fantasizing you're that cute little French poodle down the street. Then, he follows you to the piano and persists in dropping a wet, gooey tennis ball in your lap. ***You:***

A) Say, "What a charming little pup you have, Mr. Jones."

B) Ask the customer if you can try out your weighted voicing procedure on Fido's rear end.

C) Wait until the customer has gone into another part of the house, then drop kick the mutt into the wood stove.

Mr. Piano Guy is a syndicated column published by Mr. Piano Guy Academy of Piano and Toaster Oven Technology, which is solely responsible for its contents, unless you're contemplating a libel suit, in which case you should leave us alone and go after the publisher of this magazine.

Situation 3:

While you are tuning, the customer's four-year-old insists on showing you how he can play "Chopsticks" with both fists. ***You:***

A) Say, "I'd love to hear you play, but how about waiting until I'm done tuning?"

B) Say, "Would you like to see how this shank reducer works? Just stick your little finger right in here."

C) Slam the fallboard down on the whippersnapper's sticky fingers, and say to the customer as she responds to the shrieks of agony, "Gee, you know, this company's been having a problem with these things not staying open."

Situation 4:

As the customer shows you to her vintage birdcage upright that has been in the family for 500 years, she asks you what you think of it. ***You:***

A) Say, "I'm sure it serves your family very well."

B) Say, "Oh, geez, this is gonna cost you."

C) Drop a few choice epithets, walk over to the piano and hock a big looey on it, then stomp out the door, leaving a bill as you go.

Give yourself one point for each "A" response, two for each "B" and three for each time you answered "C." Then compare your score to the following scale:

4-6: Total Wimp — start selling off your tools.

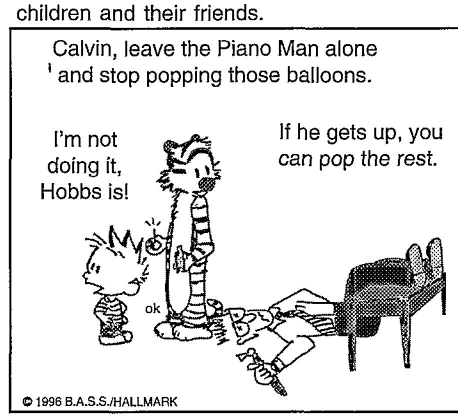
7-9: Colorful character — sure to be recommended to other customers for their enjoyment.

10-12: Certified Lunatic — Especially suited for dealer work.

That's it for this time. Next time we'll be back to the old mail bag, so keep those cards and letters coming.

PIANOMAN Adventures
by Alan Hallmark

Piano service rule #87: Beware of precocious children and their friends.



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

38* Steps to Endearment

By Sid Stone, RPT
Chairman, Ethics Committee

"Actions speak louder than words" is an often repeated proverb. It is especially applicable to politicians, to leaders of industry, and to role models. Is it also true of piano technicians? While what we ***do*** in terms of tuning and repair can endear us to our clients, we may be more endeared by what we ***say.***

These 38 Steps to Endearment are concerned more with words than actions. So it may be that words speak louder than actions in our business.

Some of the steps may contain light content to keep your attention. A few references are made to my old friend, Sam. Some of you knew Sam as a character par excellence.

1. Make a good first impression.
The well-known adage "You don't get a second chance to make a first impression" applies to all of us. The first impression may be from the yellow pages. It may be from the recorded message on your answering machine. It may be from direct phone contact. Check your telephone personality by the article in the January issue of the *Journal.* Remember to speak clearly and unhurriedly.

2. Accept and appreciate directions given.
Don't deny the client the opportunity of informing you how to get to her house. I include this as one of the 38 Steps because it has taken me some 30 years to realize that. You ***can*** teach an old dog new tricks. I used to interrupt a client by saying, rather abruptly, "If it is on the map, I can find it." I have learned to listen attentively to her pointing out various landmarks and streets. If you have a map to follow along, it is easier. Then thank her for the detailed instructions.

3. Make the client feel good.
Speak the client's name in conversation over the phone or in person. There is no sweeter sound to a person's ears than the sound of his or her own name. If you can add tactful flattery, your mission is accomplished. Even inept flattery, done by a professional, may make the client feel good. Who is more professional in this area than our old friend, Sam?

Sam had an appointment to tune a piano in a retirement community. He wanted to see if he could endear himself to the client. The conversation went something like this:

"Is Mrs. Stern in?"

"I am Mrs. Stern."

"***You*** are Mrs. Stern?"

"Yes, I am! To whom do you think you are speaking?" Sam could have guessed that she was a retired school teacher, but he chose a more productive approach.

"Oh, excuse me, Ma'am. I thought you had to be 55 before you could live here."

That one remark changed her composure from annoyance to endearment.

For Harry, there was no "too far" in going beyond the call of duty.

4. Make the client feel important.
This is good advice in all walks of life and in all situations. One step beyond making people feel good is making them feel important. A client may not realize how important she is in the musical education of her children. We can give encouragement by giving sincere compliments. More about that later.

5. Schedule appointments for the client's convenience.
Do not appear so busy that you make the client feel she is imposing on you. On the other hand, do not act as though her tuning fee is needed to pay the rent today.

Give the client a choice as to the time for tuning. This indicates that you care about her time as well as yours. Schedule enough commute time to go from one tuning to the next. If there is not enough time between appointments, you may not do your best tuning; you may not have time to do extra services needed; and you may not get to the next appointment without getting a speeding ticket.

6. Be on time.
As piano tuners we have no excuse for

being late for appointments. We know how long it takes to tune a piano, and nine times out of 10 we know how long we will be in a client's home. Other service persons do not have that advantage.

If you arrive on time, not a minute early nor a minute late, you will first of all surprise the client. More important, you will endear yourself to the client. Usually appointments are made on the hour or half hour. Do not hesitate to make an appointment 15 minutes or 45 minutes past the hour. Imagine how the client would feel if you arrive at the exact time! If you have the reputation as being the "on time tuner," you will also get more referrals.

If you are early, stop somewhere and read the *Journal,* take a nap; or if there is time, clean out your tool kit. If you will be late, even for a few minutes, call the client. This is where a car phone comes in handy. I have never regretted, nor have I ever heard of a piano technician regretting, having a car phone. A hands-free phone is preferred.

7. Park to the client's satisfaction.
Do not park in the client's driveway unless there is no other place to park. In that case ask the client's permission. If your car or truck leaks oil, park some distance away — such as in the neighbor's driveway (just kidding!).

8. Dress appropriately.
This means clean, neat clothes and a clean body. For men it is a well-shaved face and neat hair cut. For women technicians I would suggest slacks rather than a dress. Unwashed and baggy clothes are not acceptable. Some technicians wear a suit and tie. This is fine if all you do is tune. If you have to lie under a grand piano to check the pedals or take care of a squeak, then a suit and tie may be inappropriate. People who have pianos and have them serviced properly are not only caring but also intelligent people. They notice how you are dressed.

9. Respect the client's carpet.
In other words, take your shoes off and do so before you are asked. In many fine homes, especially Oriental homes, you are expected to take off your shoes before walking on the carpet. There may be a row of slippers for guests, but they are all too small for you. You should not object to taking off your shoes when you realize the reason. If it is raining, water will cling to the bottom of the shoes. Besides water, dirt and more objectionable substances may have been stepped on.

There are alternatives to shoe removal, especially during the rainy season or when the carpet has recently been shampooed. One alternative is to carry an extra pair of socks. Another one is surgeon's slippers over your shoes. If you do not have those, you might try a cheaper contrivance: plastic shopping bags. I would rather look funny than soil a carpet or catch a cold in the wintertime.

"... It may be that words speak louder than actions in our business."

10. Respect other's property.
Some homes have a hardwood floor without carpet. "Don't put your tool kit on the floor," I once was admonished. Chairs and couches may also be off limits. So where do you put your tool kit in a home with expensive carpets or hardwood floor? You may take a Gibson cloth, named after the originator. It is a cloth slightly larger than a piano bench and will easily accommodate your tool kit. If a second tool kit, supplies or vacuum sweeper are needed, take from the car the sheet or blanket to be used for that purpose. Someone has suggested rip stop nylon from a fabric store.

Care should also be taken when the music desk of a grand piano is removed, or the front panel of an upright.

11. Compliment the yard and home.
A well-kept front or back yard may be a source of pride. If the lawns, flowers, bushes, and general landscaping impress you, say so. Also, a neat home with striking decor should not go unnoticed. Admire any special paintings, pictures of children, certificates, trophies, collections, hobbies, etc.

12. Compliment the piano.
If it is a new piano, compliment the client on her wise choice. If it is an antique piano, you might have a favorable comment about the case.

What about a spinet piano? If a client asks you what you think about her spinet piano, what do you say to her? Here may be one exception to the rule "Honesty is the best policy." You do not have to lie, but you do not have to tell the truth, the whole truth, and nothing about the truth. So far I have gotten away with the answer, "It is the best in its class." I fear the day when I am asked what class that is. (By the way, one of the critics who reviewed this article has a spinet piano. I regained some endearment when I gave her a free tuning).

13. Have a neat and orderly tool kit.
Do you wait until the client leaves the room before opening your tool kit? Do you have to open it carefully so the contents will not spill out? Here is one instance where I say, "Do as I say, and not as I do!" I may be perfect in every other way, but I am still working on that tool kit.

When I am stood up by a client, I do not mind very much. I can spend the extra time cleaning up that tool kit or other kits in the car. A few tunings down the line, however, and I am back where I started. Does anyone out there relate to this problem?

(An interesting chapter mini or main technical is to have the members bring their tool kits for a "show and tell" session. Members not only will get their tool kits in order but they also may be interested in seeing what other tool kits look like and contain).

14. Be a good conversationalist.
Talk more about the other person than about yourself. Don't be a gabber, like Willie Everstop. Have a cheerful countenance. Does the room light up when you enter? Or does it light up when you leave? Knowing how to converse properly with others can endear you to them.

15. Be a good listener.
A good listener is more endearing than a good talker. It has been said that most people have poor listening habits. This is perhaps true in our profession. Look at the person as you listen as well as when you are talking. Do not interrupt. Being interested is as important as being interesting. Give your full attention to what is being said.

16. Encourage the client to ask questions.
This helps to strengthen your standing as a knowledgeable professional. Most piano owners appreciate information on the care of the piano. The question most often asked is, "How often should a piano be tuned?" The best source of information is the manufacturer of the instrument. More available information is found in some of PTG's pamphlets. A recent pamphlet is entitled, "How Often Should My Piano Be Serviced?" The attempt there is to get the piano owner or user to think in terms of more service than just tuning. Pamphlets from the National Piano Foundation are also available.

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Another question we may be asked is, "Was it far out of tune?" Clients may not notice any changes because they play and hear the piano every day. The tuner comes in once or twice a year, and he/she can tell the difference. It is like seeing my two young grandsons every week; I do not notice any changes. If I saw them only once a year, I could tell the difference.

"Was it far out of tune?" My answer might be, "You probably noticed some notes that were not just right." or "About what you would expect of a good piano that has not been tuned for a year (or whatever)."

17. Encourage children to ask questions. Most kids are inquisitive. They want to know what you are doing. A few minutes answering their questions pays off. Explain how a piano works, how a piano is tuned, and why it is important to be quiet while it is tuned. Speak loud enough so the mother can hear you from the other room. You do not want her running a vacuum sweeper or having loud radio or TV programs on.

Kids are interested in tuning forks, especially if they have seen one in school. A little trick I sometimes use is to strike the fork on my knee and touch the vibrating fork to a kid's nose. I then ask him or her how many times did the fork touch their nose if it stayed there half a second. They can not believe 220 times. An interesting phenomenon I have found is that very small children, especially Oriental children, do not flinch one bit when this happens. The reason for this is beyond the scope of this article. In other words, I have not the faintest idea. Older children and adults (try it and see) jump and start rubbing their noses.

18 Show a genuine interest in and a love for children. Kids these days may not be as lovable as kids were in years gone by.

When I was a youngster many moons ago, I was sometimes allowed to go with my mother to the general store. Before leaving, I was given a balloon. When that happened we were taught to say, "Thank you, Sir." Nowadays if a kid is given a balloon he might be more apt to say "*Blow it up!*" Fortunately, today's children whose parents are musically inclined are usually better trained, except for one. I was tuning away when a kid came into the room and instructed me not to be so loud. It was interfering with his television.

Do not pay attention to what W.C. Fields once said, "Anyone who hates dogs and kids can't be all bad." Our old friend, Sam, must have been an acquaintance with W.C. Fields. Sam loved kids almost as much as he loved drug dealers, illegal immigrants and Democrats.

One time when Sam was tuning a piano, he said to the kid who was bothering him, "Go tell your mother she wants you." Sam had a lot of good points, but his attitude toward children was not the best design for endearment.

> **"As piano tuners we have no excuse for being late for appointments."**

A better attitude would be that of Will Rogers, who said, "I never met a child I did not like." Okay, he said "a man," but the same could be said for a child. If you show a child that you like him or her, that is one good way of gaining the favor of the mother.

Show an interest in the musical education of the children. If a child is shy, you can break the ice by asking, "Are you the piano player?"

19. Learn and record the names of the children. Everyone, including children, likes to have others remember their names. Put their names on 3" x 5" cards for future reference.

One drawback to having the child's name on record is if you happen to meet the family in the mall or somewhere else. They recognize you because you are their only piano tuner. Do you recognize them out of the hundreds or thousands of clients? You may not recognize the parents let alone the names of their children. Be prepared for such an encounter.

20. Get the birthdays of the children. It is better to record the month, day, and year than their ages. Ages change from year to year, but birthdays do not. With birthdates on record you can easily figure their ages, even if it is a few years before seeing them again.

To make a special impression, send out birthday cards. Have a supply of designed birthday cards on hand. (If this is a good idea, perhaps PTG can have them available). A word of caution: If you embark on such a program, be prepared to continue it as long as you have that client.

21. Tell the age of the piano. If the client asks you how old her piano is, you may be able, after a studied inspection of the case, to tell exactly how old it is. Then, as she is watching you, get the Piano Atlas out of the kit and show her. Of course, she does not know that while she was out of the room you sneaked a look. Do you suppose that some of Sam has rubbed off on me? Nevertheless, that is one way, devious as it may be, to be endeared to the client.

22. Go beyond the call of duty. A good sign of endearment is when the client says, "Why, my last tuner never did that." This could happen after you vacuumed the piano, adjusted a bouncing hammer, tightened bench bolts, removed a surface scratch with your almond stick, replaced worn out rubber-headed tacks, took up excessive play in the pedal, etc. Any of these, or most of them, could be done in minutes. This fosters endearment

23. Give advice on moving pianos. When a piano client or owner is ready to move a piano, the number one rule is, "Don't try to move it by yourself." If you have been in an area long enough to know a good piano mover, that is the one to recommend. It is helpful if you know approximately what the charges might be, but give a wide enough range to be safe.

24. Give any treasures you find to the client. On older uprights where the keys have not been removed it is interesting what you might find on the keybed. I once found over 250 hairpins under the keys. This was many years ago and it told me something about the women back who knows when.

More likely, pennies are found. My record was 37 pennies under the keys of an old upright. Other finds included a diamond ring in a grand at a bar (the bartender knew who the owner was — oh sure!); three books of old pennies in the bottom of an upright; and in a console, an undeposited check for $250 made out to the daughter who was at the time coming home from college. The memo on the check read, "For one hell of an evening." Too bad the girl had not cashed the check, and too bad the mother was right there to see it. Apparently the bottom of the console in her bedroom was her secret hiding place. Among other goodies was her diary!!

Can you stand one more confession? In the bottom of an upright piano I once found an unwrapped, unused condom. This was immediately disavowed by the client. My endearment must have slipped a notch or two when I showed it to her.

Returning to normality, whatever you find regardless of its monetary or sentimental value, should be returned to the owner of the piano. In the case of the books of pennies I found, it took the client several calls to locate the owner.

25. Leave a memento.
Besides pamphlets on piano care by the Piano Technicians Guild and the National Piano Foundation there are other printed materials you could leave. PTG has some excellent technical bulletins. An inexpensive but effective one is the PTG bookmark. These handouts are not only useful to the client but they also promote our organization.

26. Appreciate and accept gracefully any refreshments offered.
During a tuning have you ever had a client come unexpectedly into the room with a tray of coffee, sandwiches, cookies or something else to eat or drink? Refusing that gesture of hospitality will reduce endearment. Often they will ask you if you would like to have something to drink. A client once asked Sam that question, and he replied, "I would like to have a cup of coffee, but I can't drink on an empty stomach." What else could she do but to fix his lunch?

If you are not in the mood for coffee, tea, or soft drink, you might ask for a glass of water. This way you are not denying her the privilege of serving you something. If she brings you cookies and you are not in a cookie mood, you can wrap the cookies in the napkin she brought and stuff them in your pocket or kit. I would not do that while she was there watching. As for the drink you did not ask for, you might have to swallow it or find a nearby potted plant that needs watering.

27. Have a list of the piano teachers in the area.
Often we are asked to recommend a good piano teacher. If there is a piano teachers' association in your area, you should have a list of the members. Since piano teachers always(?) recommend RPTs to their students, we should recommend their registered or certified teachers to our clients. There may be good piano teachers who are not certified, just as there may be good piano tuners who are not Registered members of the Piano Technicians Guild, but their record and ability may be questionable.

28. Be a professional appraiser.
We as piano technicians are expected to know what pianos are worth. For newer pianos the answer is easy. Refer to the Ancott Music Product Directory. It lists the makes and styles of the major brands with the average suggested retail prices. Keep in mind that the prices listed may be considerably higher than the sales prices on the floor of a store. If a piano owner (client or not) tells me she wants to sell her piano that is relatively new I check the Ancott Directory. I might tell her that she could try to get one-half of the listed suggested retail price.

For older, well-known brands it is necessary to have an idea on what it would cost for a rebuilding job and refinishing. A rebuilt, refinished piano might have a value of 60 percent to 80 percent of what it would cost new. This varies depending on the age and make of piano — and also the quality of work done. A restored "B" was once discussed at a chapter meeting, and the consensus was that it was worth 80 percent of the price of a new piano of the same size, style, and wood.

"Being interested is as important as being interesting."

For more information on piano appraisals check recent articles in the *Piano Technicians Journal.* Ward Guthrie has written some excellent and informative articles on the subject.

29. Be a professional repair estimator.
First of all, you need to know how long it takes to do certain repair jobs. The time involved can be discussed at a chapter meeting, but not prices. Even a discussion of prices among members outside the chapter meeting can be in violation of the Sherman Antitrust laws.

Some technicians make the estimate and then add a percentage to cover any hidden repairs needed. Some technicians estimate on the high side so that they can come back with a final bill lower than the estimate. They think this will make the client happy. Being the devil's advocate, I would say that with the lower amount the client may wonder what was left out.

When I give an estimate, that estimate is firm. There is no extra charge for needed repairs I overlooked. Serves me right.

You might say why not call the client and explain what extra repairs are needed and the cost?. This sounds too much like what some auto mechanics might do. If you can tell the client her piano needs more work and you can be endeared by so doing, more power to you.

30. Play the piano after tuning.
It seems as though every client believes a piano tuner is also a piano player. If I am asked to play the piano after tuning, I usually reply, "I am a piano *tuner* and not a piano *player*." I then sit down and rip off "Glow Worm" or some other fancy piece. In fact, I liked "Glow Worm" so much I played it for years after having finished with the tuning. This performance came to an abrupt halt when one client lamented, "I get so tired of hearing that piece." Right after that she moved to Florida. I was tempted to tell her I knew a piano tuner in Florida who knew "Glow Worm," but I did not want to risk what little endearment I had with her.

31. Ask the piano teacher to check out the piano.
When I first started tuning pianos I was intimidated by piano teachers. When I finished the tuning, I would grab my kit and check and immediately get out of hearing distance.

Then a startling revelation came to me. Most piano teachers have not been trained to tell if a piano is in tune or not. They may be embarrassed to refuse your request to check out the tuning. They may play a difficult piece; but are they checking the tuning or exhibiting their skills as a piano player?

I now ask every piano teacher to check the tuning. This way she is less apt to call the next day or the next week complaining about the tuning.

32. Advise clients who move out of the area.
When a client moves to another area, have a list of Registered Piano Technicians available. If the client has been satisfied with your service, she will value your recommendation. It makes my day when someone moves to the San Fran-

Continued on Next Page

Continued from Previous Page

cisco Bay area and calls me because of the recommendation of a member of PTG from another state.

33. Schedule the next tuning.
I remember at a PTG Convention several years ago LaRoy Edwards taught a class on scheduling. He made it perfectly clear that we should schedule the next tuning before we left the house. I tried that and it did not work. It didn't work because the pianos I serviced were mostly older ones and the owners were hard to convince about regular service. Then I worked for a store that sold a lot of new pianos, and then it worked. It worked for two reasons: (1) If the owner was financially able to buy a new piano, he/she was more apt to follow the recommendations of the manufacturer; (2) The store guarantee may require regular tunings. If I can not schedule the next tuning then, I let the client know when the piano should be tuned again. I then tell her I will contact her for the appointment. At least we should write on the invoice the next recommended date for tuning and ask the client if she wants to be reminded.

34. Remind the client by mail.
I have had special reminder cards printed and mailed. The effectiveness of these cards is questionable. A better reminder card is the one Isaac Sadigursky uses. He has a custom-made card that he asks the client to address. This card is then mailed to the client when the next tuning is due. She will pay more attention to the card if it is addressed in her own handwriting and if she requested the reminder. Another reminder card is used by Ron Berry. His custom-made reminder cards are addressed and mailed to the piano instead of the client. I am wondering if a card addressed to the child who takes lessons might also be better than one being addressed to the client.

35. Remind the client by phone.
When is the best time to call a client to remind her the piano needs tuning? (This would be a good topic for discussion at a chapter meeting.) Do not count on much endearment if you call at dinner time, or while she is watching her favorite soap opera.

When the phone is answered, you should first identify yourself. This eliminates the suspicion that you might be a sales person or solicitor.

If a lady answers the phone, you might tell her in a cheerful voice, "It's piano tuning time again." Now, if it happens to be a wrong number, try out your endearment strategy. Apologize, explain, and manipulate to get a tuning from her. Then, if she says she does not have a piano, you might say, "This is your lucky day. We have a sale going on now."

If a child answers the phone, have your 3" x 5" card ready with the child's name. Introduce yourself, then call her or him by name and ask to speak to the mother. You might hear an excited voice yelling, "Mommy, it's the piano tuner, and he remembered my name."

36. Change appointments.
From time to time you may have to reschedule an appointment. Consider giving a discount if you cannot make the appointment. My line is this: "It is our policy that if we have to change an appointment we will give you a $10 discount if we can reschedule." That may help to make up for any inconvenience you have caused the client. On the other hand, if the client calls to change an appointment, be sure to thank her for letting you know.

> "I am a piano TUNER and not a piano PLAYER."

37. Handle complaints promptly and properly.
Address the complaint with the attitude that the customer is always right. This means listening without interrupting. Be understanding and sympathetic. The client may say a certain note does not sound right. Don't give the impression that she does not know what she is talking about, even though you think it is in her head. Do not flaunt your expertise. If you agree with her, compliment her on her keen sense of hearing. Explain the difference between tone and tune and how each is approached. Even if you do not hear what she hears (we have all been there), you should do something. A hammer filed and/or needled may be all it takes. Then tell her it sounds better.

A common complaint is buzzes and other noises. Past *Journals* have articles on this subject. The Home Office also has a cassette tape called "Name That Noise." This might help you locate the problem. I've been told that the tape from the Home Office has lost some of its clarity. If that is the case, I have the original.

38. Always live up to PTG's Code of Ethics.
1. I will act honorably and in a professional manner.
2. I will render the best possible service under the circumstances, always keeping the best interests of my client in mind.
3. I will engage only in fair trade practices in the knowledge that I am reflecting the honesty and integrity for which the Piano Technicians Guild stands.
4. I will use the name and trademarks of the Piano Technicians Guild properly and will encourage others to do the same.
5. I will strive to upgrade my professional skills, and I will encourage and help others to do the same.
6. I will promote, in any way that I can, good will toward my profession and toward the music industry.

If you heed these 38 steps, you will be the most endeared piano tuner/technician in your area. You will also receive the best advertisement in the world, called "word of mouth."

**38 Steps... one step beyond Yamaha's 37 Steps.*

Jerry Heermans, RPT, right, receives the Emil Fries Merit Award from Dave Peake, RPT. The Emil Fries Merit Award recognizes the member who has performed exemplary service to the Portland Chapter. Jerry is one of the chapter's first presidents and recruited several original chapter members.

Industry News

Mason & Hamlin Back in Production

Pianos to be Built to Original Scale and Design Specifications

Haverhill, MA. — The Mason & Hamlin Piano Company has announced the resumption of production of its piano line, two months after the firm was purchased by Burgett, Bros., Inc. Owners Gary and Kirk Burgett also own Music Systems Research (manufacturer of PianoDisc and GT-360 QuietTime.) Production was expected to resume July 1, 1996, at the company's Haverhill, Mass., factory. The first pianos in production are the Model 50 Professional Studio Upright, and the Model A and Model BB grands. Each will be built to the same scale and design specifications as the original Mason & Hamlin pianos.

"Care will be taken to ensure the very highest production standards are met for these instruments. Only the finest materials will be used, including Renner Actions and Kluge Keyboards. Both will be standard features on all models, and the PianoDisc and GT-360 QuietTime products will be available with factory installations on the pianos as well," said Mason & Hamlin President of Marketing, Gary Burgett.

Management anticipates that the first completed pianos will come off the assembly line in October '96, making them available for the holiday season. Burgett reports that the company is busy qualifying dealers now. "So far, everyone we've talked to has been very receptive. We've have an astounding number of orders already. We'll be talking about dealership opportunities at Summer NAMM, too."

Burgett also reports that financing will be available for the line through Whirlpool, Deutsche and Textron. "Dealers appreciate that we are able to offer that option. What they appreciate even more, however, is our dedication to the legacy that came with the Mason & Hamlin name. All of our efforts will be aimed at one goal: to make sure the name Mason & Hamlin is synonymous with quality."

New Knabe Pianos Debut at Summer NAMM

Full line available as acoustic, QuietTime and PianoDisc pianos

Sacramento, CA. — Music Systems Research, manufacturer of the PianoDisc player piano system, has announced that it will begin production and distribution of Knabe pianos, and will debut at least one model at Summer NAMM. The pianos will be available with the PianoDisc system factory installed. They are replacing the PianoDisc brand of pianos which the company has been selling for many years. Knabes will also be sold as acoustic pianos or QuietTime pianos with MSR's GT-360 QuietTime mute system factory installed.

"We're incorporating some of the original, traditional American case designs in the new pianos," said MSR Executive Vice President Tom Lagomarsino. "At one time, Knabe was one of the best selling piano lines in America. All of our efforts, from production standards to marketing, will be directed toward achieving that status again."

"The addition of the PianoDisc or GT-360 QuietTime products will virtually guarantee success for these pianos," added MSR President Gary Burgett, "but they will be able to stand on their own merits as acoustic instruments as well. The Knabe name carries with it a tradition of quality which we intend to maintain."

Young Chang Awarded ISO 9001 Approval

Cerritos, CA. — Young Chang Akki Co., Ltd. is the only piano manufacturer in the world to be recognized by Lloyd's Register Quality Assurance Ltd. (LRQA) with the top ISA (International Standard Organization) 9001 approval for design and manufacturing processes of its upright and grand pianos. Young Chang received its approval earlier this year, and it is the first time that a piano manufacturer has passed all check points, including design procedures, research and development, production, facilities and warranty services.

Erkend door de Raad voor de Certificatie

Lloyd's Register Quality Assurance Ltd. was founded in 1985 in Great Britain to perform third party certification of quality management systems. LRQA is a subsidiary of Lloyd's Register, which began independent certifications in 1760. Since 1985, LRQA has assessed more than 4,000 companies worldwide. There are three tiers of ISO — 9000,9001 and 9002 — and an ISO 9001 approval is the top accreditation because it is the only level of approval to include design.

"Striving for the highest quality is nothing new to Young Chang. Young Chang worldwide has always been committed to superior manufacturing, design and customer service," said Lloyd Robbins, executive vice president, Young Chang America. "Throughout the years Young Chang has been recognized around the world with awards of excellence. The ISO 9001 approval validates the quality of our manufacturing and design."

An ISO approval assures customers and suppliers that the processes and end product of the manufacturer will be top quality.

Young Chang, the only piano manufacturer to receive the prestigious ISO 9001 approval for quality manufacturing and design, and whose pianos were selected as the "Best Piano Buy in the U.S." by *Consumer's Digest Magazine,* offers grands, uprights and consoles in over 87 styles and finishes. All Young Chang pianos are warranted to be free of defects in materials and workmanship for a period of 12 years from the date of original purchase from an authorized Young Chang dealer.

Young Chang pianos have earned an excellent reputation throughout the world among musicians, educators and music enthusiasts. For more information, contact Young Chang America, 13336 Alondra Blvd., Cerritors, Calif., 90703-2245, call 310-926-3200 or log onto Young Chang's Web site at "http://www.youngchang.com".

CALENDAR of Events

October 3-6, 1996
NYSCON
Rochester South Holidome, Rochester, NY
Contact: Robert Edwardsen
716-586-1360
Rochester, NY

October 25-27, 1996
NORTH CAROLINA REGIONAL CONFERENCE
Sheraton Airport Hotel, Charlotte, NC
Conference Director:
James Baker, RPT (704)366-8466
Registration Contact:
Lewis Spivey, RPT (919)937-4777
15 Rachel Drive, Nashville, NC 27856

October 31 - November 3, 1996
TEXAS STATE ASSOCIATION CONVENTION
Inn on Lake Travis, Austin, TX
Contact: Mike Pope
512-869-4707

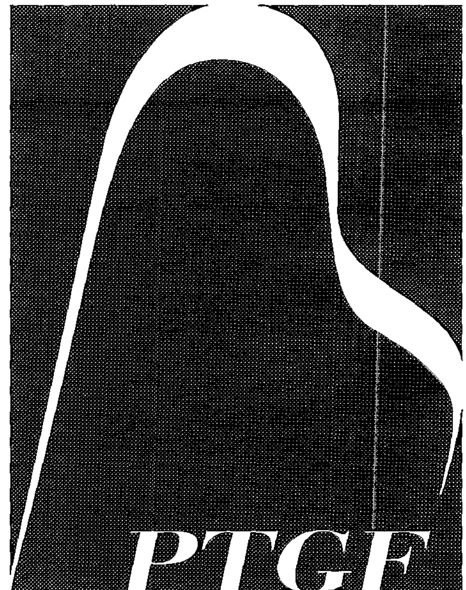
January 3-4, 1996
ARIZONA STATE SEMINAR
Tempe, Arizona
Contact: Rick Florence
119 W. San Angelo Ave, Gilbert, AZ 85234
602-926-4328

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.



The PTG Foundation Needs Your Help!

The history of PTG and its predecessors is in danger of being lost. As part of its mission, the PTG Foundation has taken on the task of preserving that history.

The work of collecting, organizing and preserving our past must be an ongoing part of our present. Your donation of money or historical materials will allow us to continue this important work. You may also designate the PTG Foundation as the beneficiary of your PTG death benefit. Contact the Home Office for details.

Honor a mentor, friend or associate, either living or deceased, with a tax-deductible contribution. Three contribution levels have been established:

- Patron ($100 or more)
- Contributor ($50-$99)
- Supporter ($35)

To make a contribution, or for more information, contact:
PTG Foundation
3930 Washington
Kansas City, MO 64111
(816) 753-7747

Associates Pass The Test

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201 WASHINGTON, DC

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RD., #1638
BALTIMORE, MD 21227

REGION 3

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2404 BROOKLAKE WEST
DENTON, TX 76207

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E. FALMOUTH, MA 02536

031 NEW HAMPSHIRE

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38 GREEN STREET, 3RD FLOOR
FITCHBURG, MA 01420

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OAKLAND, ME 04963

080 SOUTH JERSEY

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VINELAND, NJ 08360

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UNION CITY, CA 94587

945 GOLDEN GATE, CA

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ROHNERT PARK, CA 94928

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CANADA

In Memory

Thomas Sheppe
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Edgar Styles, RPT
Edmonton, AB

AUXILIARY
E X C H A N G E

Dedicated To Auxiliary News and Interests

Pencil in Your Plan

Proper Planning can Prevent Mental & Physical Stress

Stress: Fatigue! Burn-out! Words commonly heard in just about any conversation you happen to be in these days. Stress is defined as emotional or intellectual strain or tension. Fatigue is the condition of being very tired as a result of physical or mental exertion. Burn-out is to exhaust one's strength by overwork or excessive indulgence.

How can it be that with so many time-saving appliances, fast-moving vehicles and instantaneous technology that there is so much emphasis placed on stress? Is it because people are actually working harder and expending more energy than people five, 10 or 20 years ago, or is it that they are not dealing with the activities of their daily lives in such a way as to give order and balance to what they do?

As I have been observing people in general and myself in particular more closely, I tend to believe that it is not so much that people are working harder today, but rather they are placing different priorities on what is most important in their lives. No one can be all things to all people, and it is essential for an individual's mental health, which ultimately effects physical health, that organization in daily living be as important and natural as breathing. Decide today to prioritize what matters most in your life. If it is your family, of which you are an integral part, then you must first and foremost make a plan to take care of yourself. Make a list, and I mean a list, of what is important to you and ultimately their welfare. You will be surprised how short a list it is, for in our lives there are so many frivolous things we can eliminate that clutter our waking minutes and hours. With a list of what is *really* important make a plan for tomorrow and the next week and the next month. Eventually you will be able to add on a year or two. I myself, have five year plans that are not cast in concrete, but at least they are a plan with which I can build the months, weeks, and days events with an orderliness that helps me keep track of where I am and where I am going.

You will find with a plan that you can accept new challenges, turn down activities that don't really mean anything to you, and complete projects that have been on hold for too long. The old adage about "living one day at a time" is unsurpassed in wisdom, but at the same time planning ahead (always writing in pencil to accommodate change) for the days ahead can save much anguish and turmoil. With organization, energy is spent in a productive way and with it comes a great sense of accomplishment.

Now is the time to stop spinning your wheels, and floundering from day to day. Keep in mind that a little stress helps keep us on our toes, but too much will wear away our productivity. Fatigue is healthy for it tells us that our minds and bodies need to rest. It is the wise, well-planned individual that knows when to stop and rest. Burn-out is to be avoided because with it comes anger and annoyance with oneself for letting it happen. We are in control of our lives and by organizing, planning and prioritizing our activities, workloads and free-time activities we can free ourselves to live so that we can face the ups and downs that challenge our daily lives.

—*Shirley M. Erbsmehl, Recording Secretary*

FOR SALE

CLASSIFIEDS

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

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

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

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SANDERSON ACCU-TUNERS from Authorized distributor. Consignment sale of used Accu-Tuners and Sight-O-Tuners or new Accu-Tuner customers. Call for details. Rick Baldassin, 801-292-4441.

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DISPLAY AD INDEX

Piano Discussions™

August 1996

News From The World of MSR/PianoDisc, Knabe, Mason & Hamlin

Web site has world at PianoDisc's door

MSR/PianoDisc's new site on the Internet is attracting a worldwide audience. E-mail with return addresses in Europe and Asia are as common as California and New York.

Reaction to the featured products is pretty universal, too. Those who are hearing about them for the first time are thrilled to find out that something like PianoDisc or GT-360 QuietTime exists. And, of course, those who are already PianoDisc or GT-360 owners are delighted to keep up-to-date with the music library and product enhancements.

The web site itself has been getting a lot of favorable comments, too. Users praise the attractive graphics and easy-to-use format, and appreciate the referrals to other piano manufacturers and related products.

For a look at one of the smartest addresses on the Internet try **www.pianodisc.com.**

Fact: PianoDisc is America's Number One Selling Player System

Nettle & Markham join PD Artist Series

England's top piano duo, Nettle & Markham, has recorded the first piano four hands disk for the PianoDisc Music Library's Artist Series. The renowned Steinway artists made the PianoDisc recording studio the first stop on their extensive United States tour this spring.

The two pianists, who normally perform duets in concert, prepared and performed a special four hands repertoire for their first disk for any system. Pieces selected represented a wide range of composers, eras and styles, from Schubert's *Marche Militaire in D* to Gershwin's *Embraceable You* (which features a special arrangement by Nettle & Markham for this recording). The program showcases the unique skills required for executing four hand pieces, as well as Nettle & Markham's renowned technique and musicality.

"Nettle & Markham are very gifted artists who certainly rose to the challenges this disk presented. With four hands, each piece is almost as much a matter of choreography as musicianship! We think PianoDisc owners will be delighted with the results, which will be as much fun to watch as to hear," commented PianoDisc Artist Director Jan Kiser.

A late 1996 release is expected for this disk.

Our Traditions

Knabe pianos have impressive history

German-born William Knabe immigrated to America in 1833. He brought with him skills learned from the master piano builders of his homeland and his own innate business sense. That combination of skills and talent led to moderate success with his first partner, Henry Gaehle, and to extraordinary success after Gaehle withdrew from the business.

By 1860, William Knabe & Company had cornered virtually the entire piano market in the southern states. The Civil War was a severe blow to the firm, and the strain led to Knabe's death in 1864. The business was left to Knabe's two sons, William and Ernest. William, the quieter of the two, assumed management of the factories. Ernest, who had inherited their father's entrepreneurial skills, handled sales and marketing. Within 10 years the firm eclipsed its earlier success, opening additional factories, as well as offices in New York and Washington. Knabe pianos earned prizes for superior design and craftsmanship and the concert grand was used by leading virtuosos of the day, including Camille Saint-Saens.

When William died suddenly at age 48, the entire burden of the business fell on Ernest. The tremendous responsibility took its toll and within five years, he too was dead. As one of the piano industry's leading lights, his death left a gap which was difficult to fill. The company eventually joined the American Piano Company which continued to manufacture this fine piano line for years.

Knabe

Next month: Knabes in the 20th century ...

The Little Red Schoolhouse

Doug Latislaw Christine Towne Jim Houston Keith Frazier Kenneth Martin Evelyn Smith Rose Winstanley Young Sil Lee Allen Silk Robert Ballard Allen Macchia John Denker Elizabeth Chafey-Hon Peter Wolford Fred Tremper Martin Wisenbaker Olan Atherton Glenn Brown Richard Schwinn Mary Smith Daniel McMahon Charles Richey Stan LeProtti Charles Smith Ned Gilbert Paul Barber Brian Steward Delores Schaefer Patricia Biasca John Cavanaugh Dennis Gabriel Bill Barrett Peg Browne John Jeffery Neil Kusherman Bert Bartlett David Olson Harry Firstenberg Rick Florence Greg Abbott Harold Hollingshead Richard Beaton Hope Morrow Daniel Dube Tom Cobble Don Korb Danny Lyons Hal McRae Jim Faris Ray Daehnert William Winters Lyle Wood Randal Karasik Steve Sherlock Steve Anderson Stephen Bovie Richard Lowman Clark Hale Mel Fletcher Nelson Shantz Charles Hanson Sue Schmuck Michael Redden Leon Levitch Mike White Scott Colwes Ed Whitting Sr James Dowling Edward Dowling Mark Mandell Bob Jones Charles Beach David 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