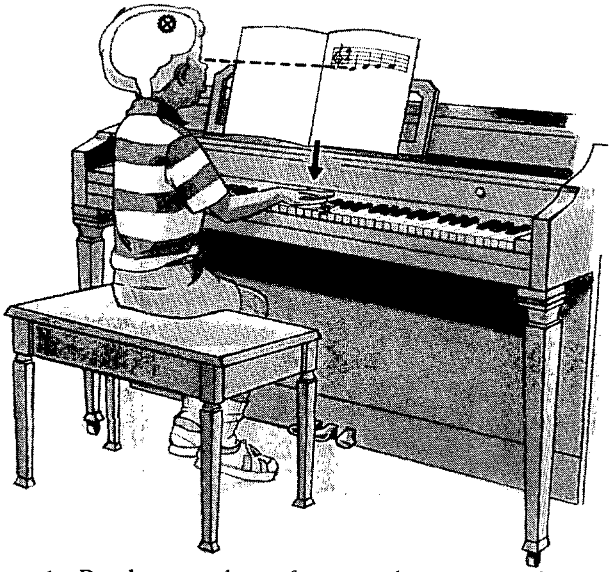
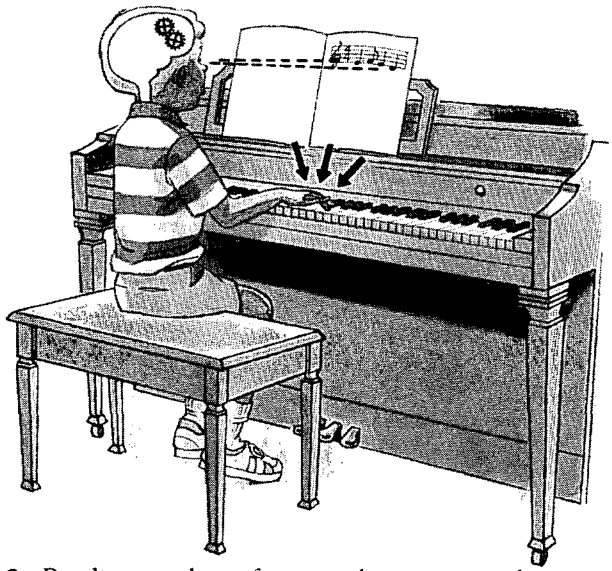
Piano Technicians
Journal
August 1990

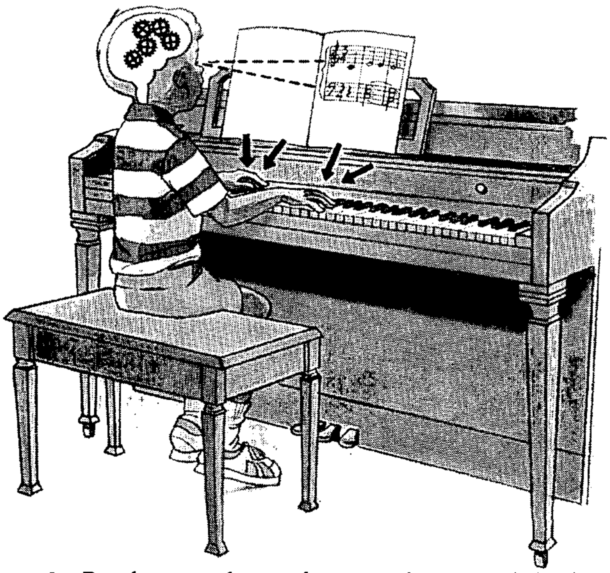
What every parent should know about the power of piano lessons in teaching a child the "3C's" . . . CONCENTRATION, COORDINATION AND CONFIDENCE.



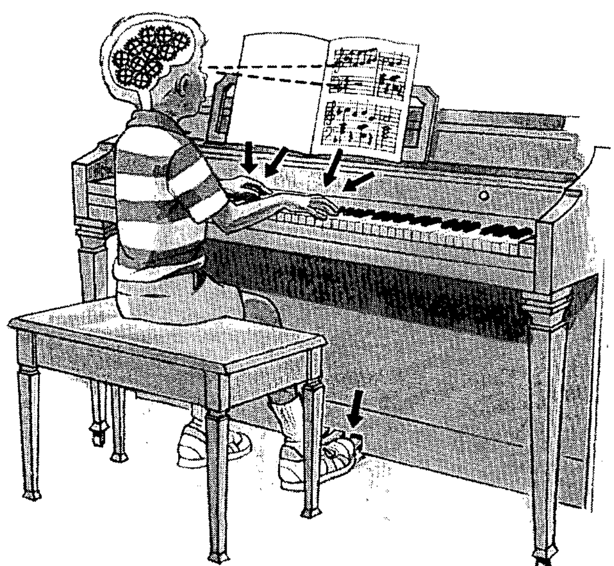
1. Reading one line of music, playing a simple one-finger melody . . . **teaches simple concentration.**



2. Reading one line of music, playing two or three notes with the right hand . . . **teaches moderate concentration.**



3. Reading two lines of music, playing with both hands, each with a different assignment . . . **teaches a high degree of concentration and coordination.**



4. Reading two lines, using both ears, both arms, fingers, legs and feet, with the brain giving each muscle a different assignment to perform simultaneously . . . **teaches intense concentration and coordination resulting in confidence.**

For a full-color version of this illustration and other information on the benefits of learning to play the piano, write Baldwin, P.O.Box 310, Department PTJ-890, Loveland, Ohio 45140-0310.

PIANO TECHNICIANS
Journal

AUGUST 1990 — VOLUME 33, NUMBER 8

OFFICIAL PUBLICATION OF THE PIANO TECHNICIANS GUILD, INC.

ABOUT THE COVER:

Another earthquake? No, just a way to make those long hours of soundboard repair less tedious. See Jack Caskey's letter in the Technical Forum for an explanation. Photo by Jim Coleman, Jr.

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

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

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President's Message

Introducing... Our New President

As your new president, I would like to take this opportunity to introduce myself to those who do not know me, and to tell you a little about myself. My name is Nolan P. Zeringue, and I was born and raised in Thibodaux, Louisiana, cajun country. I am the third president that the state of Louisiana has produced for PTG —Kelly Ward, Jess Cunningham, and me.

Nolan P. Zeringue, RTT
President

I am married to the former Deanna Blanchard, and we raised four sons, three who are now married, and we have four grandchildren.

I have my own business doing piano tuning and repair and band instrument repair. I have been in business for myself for the past 10 years. My business is probably split 50/50 between pianos and band instruments. I have been an RTT in the Piano Technicians Guild and the New Orleans Chapter since 1976. I am a charter member of NAPBIRT, the National Association of Professional Band Instrument Repair Technicians.

I came to this profession from banking, having been an officer and branch manager. I was in banking for 14 years and for the last five years or so I was also doing band instrument repair after hours. I left banking to go into band instrument repair full time. In my repair business I met an RTT who came to Thibodaux to set up a business, thus I was introduced to the Piano Technicians Guild and the piano business.

I joined the New Orleans Chapter of PTG in 1975 as a student, and passed as a craftsman in 1976. I served as treasurer, vice president, and president of the New Orleans Chapter. I was elected as Regional Vice President of the South Central Region in 1984, and served in that capacity for four years after which time I was elected vice president of PTG and served for two years.

I hope I have served you, the membership of PTG, well for the last six years and I look forward to another year on the Board of PTG as your president. I am as close as your telephone, and will certainly be happy to speak with you any time. Thank you for putting this trust in me.

In Respectful Memory

One of the best-loved and most-respected figures in the profession of piano technology is dead at age 76. George Defebaugh, who received his first piano training in 1933 and spent much of his life sharing his knowledge with others, passed away July 3. He had been in ill health for some time.

George Defebaugh, RTT
1914-1990

For the past 18 years, George had read each issue of the *Piano Technicians Journal* onto tape for visually impaired members of the Guild. He also taught at countless seminars and conventions. His lifelong dedication was recognized in 1985, when he was inducted into the Piano Technicians Guild Hall of Fame, and again in 1988, when he received the Golden Hammer Award.

A professional drummer since the age of 14, George played in service bands and was a part-time piano technician during the second world war. As a floor tuner for Lindberg Piano Co. in North Hollywood, CA, after the war, he met members of the Los Angeles Chapter of the American Society of Piano Technicians and became a member of that organization in 1954. When it merged with the National Association of Piano Tuners in 1957, George became a charter member of the new organization, PTG. He served as national recording secretary for six years, helped found the chapter program department, and served as chairman of the committee that produced the Guild film, "The Music of Sound."

He was a full-time tuner for the Los Angeles school system for 12 years, and also was a substitute instructor in piano technology for the Los Angeles Trade Technical College. After retiring from the school system in 1970, he became national technical manager for Kawai Piano Co., and later served as a technical representative for Steinway & Sons and Aeolian Corp. In 1978, he founded Superior Imports, Ltd., with his wife, Betty, and daughter, Lynn.

Memorial services were held Friday, July 13, in New Hall, CA. The family requests donations to the American Cancer Society.

Industry News

Young Chang Aquires Kurzweil Music Systems

Young Chang Akki Co., Ltd. of South Korea, the world's second largest manufacturer of acoustic pianos, has acquired selected assets of Kurzweil Music Systems, Inc. for $5.7 million.

According to S.E. Nam, president of Young Chang, who made the announcement, Young Chang will have exclusive rights to Kurzweil's technology, distribution, and will manufacture and market products using the Kurzweil name. The acquisition became official on May 29, after more than a year of discussions and planning.

The agreement calls for Young Chang to pay $3 million at the close of the transaction, plus royalties to be paid over a six-year period based on sales of Young Chang musical instruments and related products that incorporate the KMSI technology, with minimum royalties totalling $2.75 million for the period 1991 through 1992. Young Chang will provide warranty service and customer support for previously sold Kurzweil products.

Kurzweil Music Systems' first musical instrument was the K250, a sophisticated sampling keyboard and sequencer. Introduced in 1984, the K250 literally transformed the professional music industry overnight. Kurzweil subsequently expanded its product line into the semi-professional and home markets.

Pianotek U.S. Service Center For Fuji HVLP Spray Systems

Fuji Industrial Spray Equipment Ltd. of Toronto has named Marinelli Tool & Supply Co., a division of Pianotek of Ferndale, MI, as U.S. Sales & Service Center for Fuji High Volume/Low Pressure Spray Systems.

The spray systems, which meet standards for proposed U.S. regulations on air pollution control, atomize finishing materials by sheer volume of air and not by the conventional high pressure compressed air. The result is up to 80% reduction in overspray and up to 50% savings in paint, the manufacturer states.

The spray gun features two air intakes, quick release spraycup, and easy spray pattern and fluid flow adjustments. Available with Mighty-Mite (two-stage) or Super (three-stage) turbines, the units come with a two-year unconditional guarantee.

Technical Forum

From The Mailbag

Susan Graham, RTT
Technical Editor

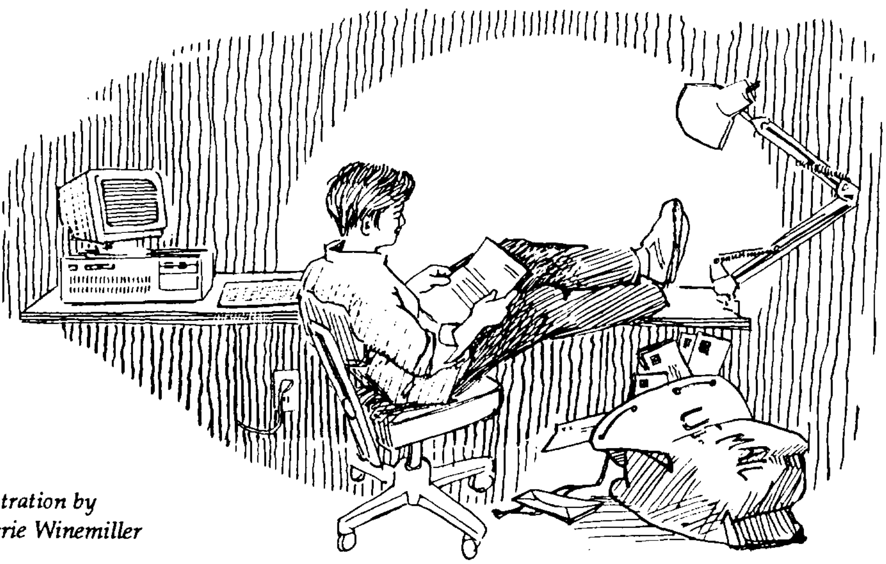


Illustration by Valerie Winemiller

Midsummer is a good time for another mailbag issue. It gives me a chance to use some of the short but cogent articles and tips which arrive as independent submissions and as part of newsletters. These things make for perfect browsing during those trips to the lake, the convention, the row upon row of practice room pianos to tune or however else you choose to spend your vacation. Hope it's a good one, and hope you find the following material as interesting, useful and diverse as I have.

We start off with some comments generated by recent material published in the *Journal:*

Dear Susan:

Enjoyed your article on soundboard shimming (May 1990). Even though I seldom, if ever, do rebuilding work anymore (it's hard work and my old bones don't like it) I enjoy reading technical articles and marvel at that some of the guys and gals are doing nowdays. A good example — the ingenious method of balance hole repair as per Bill Spurlock's article, and many other articles you've had in the recent past.

Something that caught my eye, however, was that you find yourself sitting on the soundboard, obviously to get in the best possible working position for reaching those awkward out-of-the-way areas that cracks seem to find. I certainly identify with that as I hated that part of shimming with a passion.

Then I discovered quite inadvertently that one could lick this little inconvenience by simply tipping the piano up onto the front edge of the keybed (on a blanket of course) supported by the two front legs. The piano now is standing at a diagonal posture. You can now stand there in front of the soundboard and reach any part of it that is needed and have better control of your shimming tool etc. Since the plate is removed there's no need to worry about the strain on the legs, and, one can easily lift the tail end of the piano into that position without extra help.

Some time between 1965 and 1973 I submitted an article and photo on this to the technical forum. If you happen to have these back issues you can see visually what I'm referring to. This is only nine years, or 108 copies to peruse through. (You surely can do it on some cold rainy night when you have nothing else to do but sit in front of your fireplace with your trusty dog Spot lying at your feet.)

Another by-product of this is, again, tip the piano up onto the front edge, but this time tip it further so it is in a vertical position (slightly angled over) with the top of the tail resting against the wall near the ceiling. The soundboard now is facing the wall. Now you can do all of your trapwork overhaul work standing up (or sitting on a stool) and you don't have to lay under the piano on

Steinway Repetition Assembly

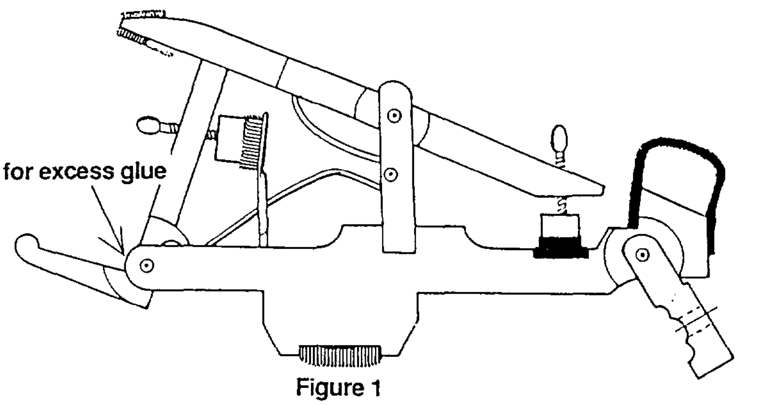


Figure 1

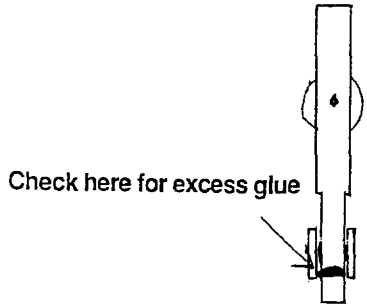


Figure 2

your back on the floor working up from underneath in an awkward manner. If all your wall space is occupied with shelves etc. you can prop the piano in this position with suitable shoring such as two-by-fours and clamps etc., etc.

Jack Caskey; Anaheim, CA

Now, Jack, you know as well as I do that we aren't due for a cold rainy night out here in California at least until late September. Fortunately, I've just received a batch of potential cover photos from Jim Coleman, Jr., including, of all things, an illustration of the very technique you suggest. Many thanks to both of you!

Here's another possible solution to the repetition problems discussed at some length in several issues this year:

Dear Susan:

I am writing in regard to the problem of poor repetition in Steinway grands which have Renner wippens, shanks, and flanges. I have read the previous articles containing various ideas and solutions and would like to contribute a couple of my own. (I am the technician for Arizona State University and have installed several complete sets in the last year.)

I have found that certain notes had problems, while others were fine. Upon closer examination, I discovered that 10 to 15 wippens in each of the sets I have installed in the last year had excess glue squeeze at the jack tender joint (figure 1). Figure 2 illustrates how the glue can contact the side of the jack cradle and create friction. This friction impairs free movement of the jack resulting in poor to non-existent repetition.

A simple procedure performed prior to installation will rectify this problem: carefully trim the excess glue from the jack with a razor blade. (The procedure can be accomplished after the wippens have been installed, but is much more difficult.)

Two other procedures I have found helpful in overcoming poor repetition are: 1. Checking the jack flange resistance; 2. Buffing the tops of the jacks

The jack flange resistance can be checked by removing the repetition spring from the slot in the back of the jack. This allows the jack to move freely in the cradle. A gram weight resistance gauge can now be applied to the jack tender and an accurate reading will be obtained by applying just enough pressure to produce movement of the jack. This resistance is referred to as "static resistance," the amount of force needed to set an object into motion from a rest position. I prefer the resistance to be no more than 3.5 grams. If a gauge is unavailable, it is possible to place a penny on the tender and observe the movement of the jack. (A penny weighs 3.2 grams). Jack flanges which are too tight should be reamed and re-pinned with the next largest center pin size.

Buffing the jacks should also be performed prior to installation. With a high speed cloth buffing wheel and some TC6 Tripoli polish, hold down the repetition lever (Steinway calls it a "Balancier") with your index finger until the tip of the jack is exposed. Steady the assembly with your free hand and hold the top of the jack against the wheel for about three seconds. (I prefer to have the travel of the wheel from the back of the jack (flange end) to the front. This allows the buffer to catch the rounded edge of the jack.) This will remove some or all of the factory-applied lubricant. I like to replace it with McLube 1725 spray (available through McCall Piano Service, Phone (714) 622-8826).

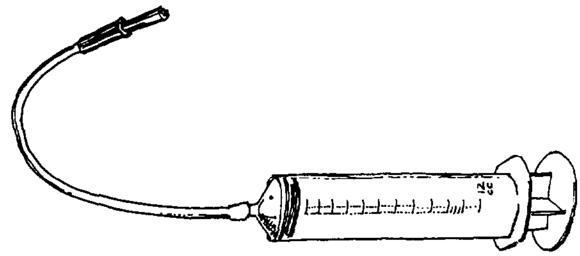
Last but not least is the importance of proper action regulation. Even if all the parts are perfect, good repetition will only occur if they are in the correct relationship with one another.

On a side note, I weighed several different hammers that I have in stock for replacement on various Steinway grands and found that the Renner hammers were lighter than the factory Steinway hammers. I would be interested to know why Renner used a thicker repetition spring.

Michael C. Spreeman; Mesa, Arizona

We all use a variety of syringes and squeeze bottles for a host of functions — here's a homemade arrangement which works well:

To make a gluer that reaches, I put



together a disposable animal-injection syringe with a short piece of clear plastic hose that they have at the hardware, capped with those removable indented tops of pens made by Associated. Without imperfections in the plunger ring, testing for one year has yielded no crusting, with a period of a month without use.

Jim Hochstedler; Gilman, WI

I know sometimes I'm guilty of neglecting work on vertical pianos (of course, Bill Spurlock and Fern Henry have the topic well in hand). Here are a couple of useful tips; one for new verticals and one for old.

Just some information I thought I'd share with other Journal *readers concerning an item that I don't recall having been covered before.*

There are a few makes of new Asian pianos having sticking keys where the cause isn't due to anything normally under consideration: overly tight key bushings, action centers, binding keyslips, even tarnished damper spoons. The first time I was made aware of it was last year; after I exhausted all the possible 1,001 causes and the sticking still persisted, I finally contacted the piano company's service department. They told me to adjust the let-off rail (moving it very slightly forward) so apparently they were encountering the same problem in that particular model.

However, I have encountered the same situation in other Asian makes since then. I would be curious to know if anyone else has experience with this.

Mark Mandell; Los Angeles Chapter

I've printed Mr. Mandell's letter as submitted, but let me be the first to say that I've encountered this problem on domestic as well as foreign pianos. My understanding of the source is that the back (or distal) edge of the let-off button rail has been felted and is acting as the stop for the jacks (to prevent them flying too far out on a hard blow, a function sometimes performed by a felt square on the inside of the catcher). If this rail is too close, or the wood of the jacks is slightly rough, the contact may result in the jack hanging up momentarily. As we all know, a moment of hang-up can result in a whole lot of headache....thanks for bringing this to our attention. The solution of moving the rail slightly away from the jacks is the best one I know. With any luck, this won't throw off the let-off adjustment (especially if the piano has not had enough heavy use to dent the button cushions) but check to be sure.

Our next tip comes from Ernie Vagias, who's been working on pianos for a while — long enough to know that sometimes the prescribed repairs won't work but you still need a way to get the instrument up and running:

Brass plate actions can be frustrating when the plate tongues are broken. Of course, they can be repaired with repair clips but they are very unstable and shift in the piano (unless they are locked in position with contact cement). Even so, they are not easy to install because tongues break at various points on the plate.

The method I employ is:

1. Remove the hammer (A) on the left of the broken tongue and the hammer (C) on the right of the broken tongue.

2. Remove the center pins from A and C butts and from the hammer corresponding to the broken tongue.

3. Install new center pins in A and C butts but not in B and do not clip off pins.

4. Push center pin of A flush with left side of butt and center pin of C flush with right side of butt. We now have butts A and C with center pins installed with extended ends.

5. Attach butt B to extended ends of center pins in A and C and we now have hammer B riding on the extended ends.

6. Attach hammers to rail and lock plates on A and C.

Some technicians will think that hammer B will shift from side to side, but this will not happen. In my experience, hammer B will swing dead center. For any doubters, I suggest they use paper punchings between the butts as arresting stabilizers. It works!

Ernie Vagias; Pittsburgh Chapter

Newsletter Reprints

There's a lot of good information going out in chapter newsletters. I've picked out just a few. Several come from Harry Buyce in the Western Michigan chapter newsletter:

Have you ever had to clean the lacquer off the different brass parts of the piano? Messy, isn't it! Try some oven cleaner in a spray can. You can wipe it off with paper towels or wash it off with water. Then shine it up and respray. Sure beats paint remover.

Do you have a school, church, motel, or any other place where they have a new studio piano that they move from room to room? Does it look like they have hit every wall, door jamb, desk, or any other obstacle that might have gotten in their way? The toe blocks are all chopped up and the front of the keybed never missed a corner. If yes, go down to your automotive store and buy a roll of side molding for cars. It comes in brown or black and has the sticky already on it. Cut this to fit with tin snips along with the 45 degree angle on the corners. Your piano will look much better after moving. Won't it peel the finish off if you remove the molding? Probably will, but it's easier to patch the finish than to replace missing wood. Give credit for this one to Kelly Bakker and Harry Buyce.

Ever have trouble with your rubber wedges falling because they won't stick and start to feel hard? Try washing them off with lighter fluid once in a while. That will make them more like they were when they were new.

While we're on the subject of metal cleaning, here's a suggestion from Bob Lemon of Sacramento, appearing in *The Valley Technician* (Sacramento Chapter):.

Metal parts in pianos can be cleaned easily and quickly by using Jasco Metal Etch. *Use according to the instructions on the bottle, or make the solution a little weaker. The solution may be used more than once and should be stored in a plastic container* clearly *marked. To be on the safe side — use rubber gloves when working with acid. Be sure to remove all lacquer or paint from metal parts with the proper solvents before subjecting the parts to the acid bath. A heated solution works best. (Don't use metal containers!) To remove rust or iron scale, heat solution to approximately 140° and watch it go!! Thoroughly rinse parts with water when cleaned; dry immediately to prevent rusting. Polish or buff after acid treatment. Spray with a sealer — lacquer or other desired finish. We use one container with acid for all brass, copper and brass plated parts and a second acid container for steel, cast iron or plated parts.* Do not use on zinc or aluminum castings. *The acid works almost instantly on brass or copper, so keep an eye on the action. Steel and cast iron take longer to clean, but don't forget to check every few minutes to see how the cleaning is progressing.*

Robert Lemon

And as long as we're perusing *The Valley Technician*, here's an offering from Yvonne Ashmore:

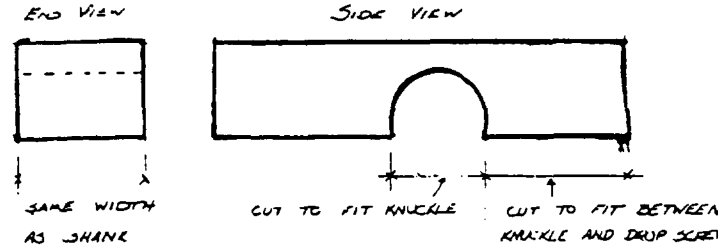
If you haven't made your glass bead booth yet, but you do have a set of ugly keys *that you would like to clean up, you can do it with a fine wire brush in your buffing wheel arbor or a drill motor. Just barely touch the wood to the spinning wire wheel and most of the rodent, liquor, and whatever stains will vaporize. I do mine on the buffing wheel arbor; holding four to five keys in a bunch, I move them back and forth across the wheel and watch the clean wood appear. It takes about 15 minutes to do the top surface of a set of key sticks this way. If you try it, be sure to wear a dust mask because all the dirt will be floating around in the air.*

Yvonne Ashmore

And a two-for-one quickie from Bill Ballard in *The Granite Action* (New Hampshire Chapter). There's also an article appearing a little later in the "Forum" which Bill submitted to me; I've been so slow in printing it that it may have appeared in *The Granite Action* by now as well.

If you have a grand keyframe with a bunged-out shift lever channel, and you're looking for a good material to inlay at that spot, how about the horn beam strips which Renner packs its shank set with? It's tougher than maple, and its size (approximately 9/16" by 7/32") is just right. If you're looking for a router small enough to fence and maneuver on the limited area of a keyframe bottom, the Rockwell Offset Laminate Trimmer (#311, with 3.8 amp motor) has plenty of power. I originally bought it to rout shim channels in soundboards, and have since found it very handy for small jobs like hinge *inlaying, which don't require a two-hand grip, and which would be obstructed by a conventional size base.*

Bill Ballard; New Hampshire Chapter



Climate control is an important aspect of good piano service. While many of us take steps to rectify excesses in humidity and/or dryness, there's another factor which may escape attention. Jeannie O'Link, writing in *Soundboard Buttons* (Twin Cities Chapter), outlines the consequences very clearly.

During the past year I've worked on many pianos for clients that are new owners of a piano. Sometimes the pianos are brand new, sometimes used and needing repair, and sometimes restored or rebuilt and almost like new. In all cases, the new owners are proud of their new purchases and have to choose where to put the piano. Sometimes there are a lot of location choices, and sometimes there is only one choice.

One factor most people don't consider, including piano tuners (and myself), is the sun. Does the sun ever hit the piano in its present location? I never realized before how little sun it takes to start doing severe damage in a short time. Here are some examples that I've encountered this past year.

Example A: A brand new glossy black grand piano was placed in the southwest corner with windows south and west. It had been thoroughly regulated and tuned and felt wonderful and sounded great! No one thought about the low winter sun. Three weeks later, the piano felt awful and was hardly playable. What happened? A thorough examination of the piano revealed that 1. the keybed had split and cracked; 2. several keys had twisted and warped; 3. hammer shanks warped; 4. the keyslip *had warped and was rubbing on the keys*

A brand new piano was ruined in only three weeks. What happened?

During those three weeks, the sun shone on the piano only four hours a day. It superheated the air temperature in that corner from 70° to 105°, and changed the humidity from 43% down to 23%. That's a 35° temperature change and a 30% humidity change in four hours. And when the sun angle changed and no longer shone through the window, the temperature dropped back to 70° and 43% humidity. Imagine the daily stress on the wood in that piano! (Also note: Room humidifiers were operating during this time period with a humidity gauge monitoring the humidity level at 43%. But, the humidity gauge was in the center part of the room away from the windows and sun influence.)

Example B: A restored grand piano, whose tuning pins checked out tight in the shop, was sold and placed in the southeast corner of a home with windows east and south. Also, a Dampp-Chaser humidifier and climate control system had been properly installed underneath the piano. There were some trees nearby which provided shade in the summer, but not the winter. Again, the low winter sun shines on the dark walnut finish of the piano two to three hours a day. In three months, the pinblock had dried out enough where tuning pins will no longer hold the string tension. Shades on the windows pulled during those sun hours would have prevented this damage. Even the humidifying system was not enough to counter the intense drying effects of the sun. Again, the sun superheated the air around the piano. This causes the air to expand thereby driving the humidity down to levels as dry as the desert.

Example C: This last example concerns a 30-year-old console piano that was in mint condition. I tuned it in December and found the tuning pins so tight it felt like a new piano. It had been well taken care of. In January it was sold. It was moved to the new owner's house and placed on an inside wall away from heat registers. In February I was asked to tune it by the new owner. I couldn't believe it! The tuning pins felt so loose! I even had to pound some in to get them to hold. What happened?

It was a cloudy day and I was tuning, the clouds broke and the sun came shining on the action. There was a west window on the wall next to the piano. Again, the low winter sun had been shining on this piano for several days, and that's all it took was one month to loosen up a tight pinblock. In the summer there are several shade trees and the sun angle is higher, so the sun is not a problem then. Moving the piano or pulling the curtains would have prevented this.

Summary: Now when I make a service call I make sure to evaluate the piano location of every client's piano and especially determine if there are any sun concerns, offering suggestions to the owners if needed. This past winter I've learned that winter home heat combined with sunshine is deadly *for pianos whether new or old. So watch out for piano enemy number one — the* sun*!!! It takes so very little sunshine in such a short time to do extensive damage. How do we help our clients combat such a foe?*

1. Move the piano to a non-sun, non-heat *register location or an inside wall if possible.*

2. If moving is not possible, protect the piano by pulling shades or draperies during those times of day when the sun shines on the piano.

3. Especially if it's a sunny room, humidify the room and/or piano to 40-45% and maintain that humidity level throughout the winter.

4. Have a humidity and temperature gauge on or near the piano to monitor conditions.

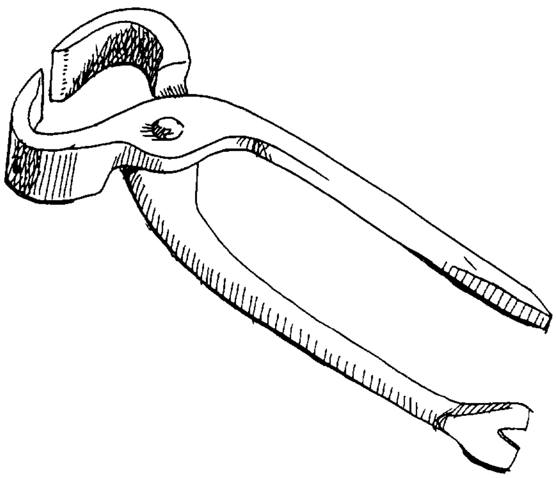
5. Inform the client when hostile conditions for the piano exists, whether sun, heat register, and/or wooden stove.

6. Have clients treat their pianos regularly with an appropriate piano polish. Check with manufacturer's recommendations or a piano refinisher for advice on best product if you're unsure what to use.

7. Homes with wood heat are especially dry and some sort of humidifying system (whether furnace, room, and/or piano humidifier) is a must or the piano will not hold up over time. It will fall apart prematurely.

Due to these experiences I've become real sun sensitive and location sensitive concerning my clients' pianos. I've also gained a new respect for the strength and intensity of sunpower, something I had not considered before.

The Forum for this month finishes with three articles. The article following the Forum is a reprint of an article on super glues which appeared in the Feb-



ruary 1989 issue of *Popular Science*. This, too, has been reprinted in several newsletters and handouts; it offers a good overview of the products and applications available in a rapidly expanding field, so I felt it was worth space in the *Journal*.

"New Life for Old Hammer Shanks" by Kerry Kean has appeared in *Butts and Flanges* (Cleveland Chapter) and in the *College and University Technicians Newsletter*. Kerry Kean, RTT, is the piano technician for the School of Music at Kent State University in Ohio. He is also a member of the College and University Technicians Committee, and the Cleveland Chapter.

And, as mentioned, we include in this month "The Una Corda in Voicing" by Bill Ballard, RTT, of the New Hampshire Chapter. Thanks, everybody, and enjoy the rest of the summer.

New Life For Old Hammer Shanks

Rebuilding pianos in a music school frequently presents us with different problems from those normally confronted by our colleagues in private business. Since the problems vary, of course, so do the solutions. One good example of this is the question of what to do with hammer shanks and flanges when rebuilding a grand action.

In the private sector, by the time a grand piano makes it to the rebuilding shop, it is probably 60-plus years old. Besides the usual hammer shank ailments, like flat knuckles and loose pinnings, the wood is probably brittle or close to it. Hanging new hammers on these tired old parts would be poor economy and in some cases, would actually amount to cheating the customer. In a music school, however, we frequently see action parts prematurely worn down by excessive use. When comparing the cost of new parts against the time involved in reconditioning the old ones, replacement usually wins. Sometimes, however, good quality, identical replacement parts, or the money to buy them are just not available; if you have competent student helpers, that may also tilt you in the direction of reconditioning. Let's take a look at the pros and cons of each option.

On the old shanks and flanges, if there is any doubt about the condition of the wood, they should automatically be thrown out. The shank must have some flexibility, so bend a few to check it; the presence of previously broken and repaired and/or replaced shanks is another good clue. Likewise if another technician has already hung a set of replacement hammers on the original shanks, pitch 'em. Even if your predecessor followed the strike line correctly, a third set of hammers on one set of shanks is asking too much of the wood. (It's probably also bad luck.)

The other things to check on the old parts are the conditions of the center pins and knuckles. An entire set of shanks can reamed and repinned fairly quickly, provided that they are not contaminated with very many oversize pins, meaning anything over about #21 1/2 or #22. Repinning an entire set with too-large pins is a bad idea because the additional friction area presented to the bushing makes uniform pinning difficult; it also seems logical to me that seasonal changes in tightness would be more extreme. A random sampling of pin sizes, particularly from the center sections, should give a fairly accurate picture of the situation.

If the knuckles are not too badly worn, they can be bolstered to restore shape and the surface sanded smooth, or they can be replaced. If you elect to replace with new knuckles, you should have them in your hand before you remove the old ones. There is a wide variety of quality levels available, and price is not necessarily a valid guide. (In the recent past, I have found the imported knuckles to be superior, although I continue to hope that will change.) Also, an exact fit in width and diameter is critical to proper regulation of the action and the core wood must fit snugly in its mortise for a good glue joint. Make sure that your new parts fit all these criteria before making your final decision.

If you have worked with new parts before, then you know that even if you order a set of high quality, identical-to-the-original-in-every-way hammer shanks, you will not be able to simply take them from the box and throw them on the stack. The firmness of the pinning should vary from bass to treble in order to accommodate the weight of the hammers, so that each hammer-and-shank, when held by the flange and allowed to drop from a horizontal position, will swing the same number of times as the rest. The amount of work involved can vary greatly from set to set, as can the amount of traveling and shank burning that will be required after installation. Experience is your best guide, but it also doesn't hurt to have samples on hand of the types of shanks available from different sources.

Okay. You've examined all the facts, weighed all of the possibilities, and you've decided to recondition the original shanks and flanges. Now for a refresher course on the true meaning of 88. (After doing enough things 88 times that number seems to take on an almost mystical significance.)

First though, before removing any parts, re-check the strike line. Even though this should have been a part of your evaluation process, do it again. Dry-hang a few hammers from your new set in the top two sections, and compare these with the originals. If you are going to change the strike point anywhere, especially away from the keys, you need to know now. If the old shanks are not going to be long enough to allow you to hang the hammers where the piano tells you they belong, you may want to reconsider your decision to keep the old shanks.

If everything checks out, remove

the shanks and flanges and replace the screws in their original holes as you go. The next order of business is to remove the old hammers, except for whatever samples you need to hang the new ones. there are tools designed to do this, or you can cut the old hammers off with a diagonal cutter. Then, with a hammer shank reducer, carefully remove the glue collar, fragments of the head, and just enough wood to provide a clean, round gluing surface. Uniformity is very important, as is retaining enough of the shank for strength, so be very critical of the tool's adjustment; it helps to make a pair of tooling marks on the body and collar of the reducer, once the proper adjustment is determined, and to check the alignment frequently. Also, if you have your hammers custom-bored by your supplier, don't forget to measure the shank after reducing, in order to specify the correct drill size.

If the buckskin on the knuckles is not too badly worn (and if it was of good quality to begin with; knuckles made during the buckskin shortages of the '70s and early '80s in particular should be examined carefully) the knuckle can be bolstered to restore the critical profile, and cleaned. This is simple with the shanks off the stack: First, determine the proper thickness and width of material to be used. Bushing cloth is excellent for this, especially that cheap, pink stuff that the supply houses still sell as their standard. It's a little softer than the good cloth, and I've had lots of it lying around in boxes of odds and ends ever since I found out about the good stuff. Cut the end to a sharp point and dip it in lacquer or other quick-drying hardener. Draw the cloth through several knuckles, between the leather and the felt, stringing them like beads all the way to the end of the strip. Then lay the whole string down on the bench, knuckles up, with the drop screws off the edge, and clamp a straight edge across the shanks to hold them in place. Now you can sand off the grooves in the buckskin. I use a long hammer filing stick with 60 grit garnet paper, placing the stick lengthwise along the hammer side of the knuckles, pulling it up and over toward me in short strokes, and then back the other way, trying to shape the knuckles as well as removing the worn outer layers. If this procedure does not remove most of the encrusted graphite and dirt, you can use a dry-cleaning fluid, but be careful to have good ventilation. The fumes are really toxic. Then I file again, using the same techniques, with a 180 or 220 paper. Follow this with a soft-bristled brass wire brush, stroking with the nap, and you have a very nice, round, smooth knuckle.

If you decide to replace the knuckles, the match-up of the old with the new, as noted before, is critical: the width and diameter of the roller and the size of the core wood must all be near-duplicates of the originals or you're going to have trouble. Here again, as with other action parts, having samples of all other available types is invaluable, cheap insurance. When you're building your collection, check with the parts departments of the piano manufacturers as well as the supply houses. They are good sources of diverse types of parts (Baldwin, for example, is a reliable source for Renner knuckles).

There are two tools that I like for removing knuckles. One is an old, dull part of flush-cut center pin nippers (these are also very hardy for trimming key bushings, which is probably why they're dull in the first place). They work on the same principle as the old strong-man trick of tearing a phone book in half; by tearing one page at a time, but very quickly, you get the illusion of one mighty rip. By placing the nippers with the flat side against the shank on both sides of the knuckle and squeezing gently, the glue joint is broken loose a little at a time, the knuckle comes up at one end and can easily be pulled out. This works really well on Steinway knuckles, with the extra fold of buckskin that frustrates the use of any other tool, and works with varying degrees of success on others. If a larger tool is needed, diagonal cutters work the same way or failing that, the bolt cutters sold by Schaff as "knuckle pincers" will do, although with this tool you are trying to break the entire glue joint at once. This puts a lot more strain on the wood and sometimes results in broken shanks.

After removing all the knuckles, carefully clean out the mortises of any glue remnants. The area next to the mortise is not critical, since the buckskin will forgive more lumps than the core wood, but it should be free of any chunks of glue or other debris. A simple press for gluing in the new knuckles can be made from hardwood stock (see figure 1). First, dry fit the knuckles to be sure they will be a good press fit, but not so tight that you can't push them part way in by hand. Apply your favorite adhesive to both the mortise and the knuckle core and press the knuckle into the slot as far as possible, with the nap of the buckskin pointing away from the flange. Make sure to align everything carefully now, adjustments won't be possible later. Lay the knuckle into the form, place a thick piece of wood on the other side to protect the shank, and use a large plier or "C" clamp to squeeze everything together. Check the knuckle carefully to be sure it is pressed completely into the mortise and that the striking surface is parallel to the underside of the shank. This is critical, so if anything is not right, correct it now. I recall reading in the *Journal* a while back that someone used a press like this in a vise; I haven't tried it , but it seems like a good idea.

There are several ways to approach regulating the pinning of an entire set of shanks. One approach which works well is basically the same procedure I use with new parts. Fit the number one bass hammer from the new set onto a shank and apply the swing test. Keep doing this with different shanks until you find one that gives you seven swings. Then check the same shank using the number 88 hammer, which should give you two or three swings. Now test all of the shanks with number 88 and divide them into groups according to how many swings each one gives. any which give fewer than two or more than seven are repinned to fit into whichever group has the fewest shanks. The shanks are then hung in order, starting with the two's in the bass. If some of the shanks are thinned for use in the upper treble, it is important to maintain this division so plan and re-pin accordingly. When using this procedure with old shanks, you also have to remove all of the old traveling paper from the flanges and hammer rail.

If most of the centers are loose, a

better approach is to ream and re-pin them all on a production line basis. Using some kind of depth stop on your reamer, (the collar and set screw from an old upright damper block works nicely), ream and burnish the bushings at about three different settings, so you again get shanks which vary on the swing test (with number 88 hammer) from two or three in the bass to seven in the treble, and install new center pins. If you do have to use a few pins of size 22 or larger, put them at the ends of the keyboard, or better yet, rebush the centers.

Whether you re-do the old or put on the new, every component of the hammer shank has a critical effect on the smoothness, power and reliability of the action. If you do them right, as part of an overall quality rebuilding job, you'll earn a little inner smile every time you see that piano. For a college technician, who lives in close proximity to both his success and failures, that can mean a lot.

The Una Corda In Voicing

The monthly installments by the *Journal* Editor on the well-reconditioned and regulated grand piano are exciting for their encyclopedic coverage of a vast territory. Let me add a few paragraphs to the recent description of hammer-string contact work as the necessary preparation for good voicing, and more specifically, the una corda. The proper regulation of this feature of the piano should be attended to for the many pianists who go directly to the una corda to judge the thoroughness of the piano's voicing. As well, the contribution of each trichord string to the tone quality of that note rises from 33% to 50% when the action is fully shifted, making string by string work absolutely critical. How many of us have noticed that the carefully compromised unison with two or even three false-beating strings in the standard position reverts to a simple bad unison when the left string of that three-way compromise is removed. Similarly, any less than perfect hammer-string work will be loudly broadcast when the action is shifted over.

I used to be committed to elaborate means of string leveling which once included sliding a dial indicator underneath the strike-line and leveling strings to within two mils, and more recently, moving the pivot point of a Robinson Strate-Mate so that the nylon roller would bearing on the underside of the strike line and signal notes whose strings didn't form a line parallel to the keybed. But good hammer filing simplifies all of this. The squareness of the line across each hammer's strike-point can easily be verified by viewing the hammer crown between a dark background (say, the fallboard) and a straightedge set on top of the hammer flanges. (Or, as I once saw Ludwig Tomescu of Steinway's basement do, viewing the hammers against the bottom edge of the front stretcher and highlighted against light from an overhead fixture shining down through the strings and onto the keybed. This latter point of view, useful on stage, requires raising the front of the keyframe so as to put the hammerline, the stretcher and the keybed light all in the proper line-of-sight. In any case, make sure that the part of the hammer you're sighting across is the actual crown rather than the top of the shoulder.) Regardless of how you establish it, this set of absolutely square hammer strike surfaces is my starting point for open string work.

I do this work for both standard and full-shift positions for one good reason beyond insuring the shift position doesn't get forgotten: these two positions will tell me which of the two partners (the hammer crown and the string strike line) is causing the open string. With the hammer filing and string-chip leveling behind me, I ask the whole crowd, "Are you guys all straight?" and, like something out of Silly Symphonies, they chime back, "Yes, Boss!" I'll find out who's lying to me in short order.

Holding one note's damper up with the sostenuto, I pluck strings as described in both standard and shift position (yes, both feet on the job!), and note the pattern of openness of the three strings (not just which is open but also the relative strength of the contact pressures.) If there are no open strings and even contact pressure in both position then everybody's leveling with me. If a pattern with an open string is unchanged but moves with the shift of the keyframe, then the hammers aren't on the up and up. If the pattern stays the same and also stays put then it's the strings which are finking on me. And you know everybody's lying if the pattern changes between positions: it's back to square one, checking the squareness of your filing. Would I accept good contact in both positions on an out-of-square hammer? With this KGB-style technique for ferreting out crookedness, there's no reason to put up with such affronts to my eyesight. One advantage of this technique is that the una corda open string work (and hence, voicing) is not an afterthought, but something to be dealt with at the same time and, of equal importance good contact in both positions simultaneously is that this condition is virtually guaranteed in all the intermediate positions.

If the overall strategy of regulation and voicing is to marshall all of the power of the action and hammers and then decide how much of that is musically desirable, then such a complete hammer-string fitting is a full-throttle test of the piano. You will observe some settling-in of the open-string work during the first hour or so of the voicing, especially as the crown puffs up from the initial acupuncture. But fairly soon, you'll find that the uneven timbre from string to string is no longer due to poor contact or other string voicing. What a pleasure it is to have the piano finally in such a condition that only the voicing needle is required to perfect the tone, and your concentration can devote itself entirely to the effects of that tool.

Another aspect of una corda voicing has to do with half-pedaling. It's natural for a pianist to assume that if the action can be operated with anything in between feather-lite and full force, the shift pedal is equally capable of intermediate levels of effect. I explored this esoteric corner of regulation recently, and found a variety of opinions among technicians as to its practical value, ranging from the belief that while shadings were to be found this way, they didn't travel more than 20 feet from the piano, to the suggestion that any pianist requesting such a regulation should be sent down to the shipping department to have his or her ears boxed (and here I paraphrase).

The general opinion was first, as mentioned, that tone quality could be subtracted from if the hammer crown, after all the doping and needling, didn't have a uniform texture all across its width (not just at the full on and off positions). This must be listened for. Secondly, the only point in the shift of the hammers that a distinct new shade is added is when the hammer is just barely grazing the left-hand string. A pianist looking for this singular timbre will be driven mad if the hammer spacing isn't such that all of the trichord hammers leave the left-hand string at the same point in the shift. The time required to establish this kink spacing (as well as the early-on realization of its fragility) is equally maddening to the technician. But it can be done, and you will be rewarded with a halo.

The time-honored technique of spacing the hammer's left edge between the left and center strings with the keyboard fully shifted may get quite close to the needed spacing and can conceivably hit it on the nose. However, I prefer to do my spacing at that "jumping-off point." This can be determined by selecting the numbered drill bit which, when placed between the bass keyblock and the keyframe, will yield the greatest number of hammers ready to jump. Henceforth, this drill bit will be your shim to relocate that spot in the shift, for this and any subsequent regulation. (75% of full shift is a good neighborhood for this spot). But even nailing down this spot doesn't make the spacing an easy matter. Your spacing now is being done not by eye but by ear. Using a mute (rubber or thumb) to hear only the left string, walk up the scale, listening to the volume from the left string and spacing to equalize this volume. With such a slight contact on the left string by the hammer's edge, inconsistent touches on the keyboard are going to interfere seriously with your judgement. You will, however, be thankful for this practice with even touch later on during the voicing. Also, don't get concerned if this kind of spacing takes twice as long as the usual, because you'll have no trouble getting paid for the results. And one final detail, this time about spacing in the bichords. The scale spacing and hammer angles rarely allow the hammers to clear the left string of a bichord. The best you can get (and it's much better than nothing) is a partial blow on the left string at full shift.

For me, techniques such as these are based on concise definitions of what a good regulation needs. We may be taught them by an old master, or in a Guild classroom, or as chance may have it by one of our pianos. Regardless of how we may come by them, they all certainly belong in the Big Book of Piano Work being added to, with each *Journal*. Maybe I'll open next month's issue and find the answer to my current una corda riddle: why a hammer (typically in the fifth or sixth octave) sounding reasonable in the standard position and deathly anemic when shifted should have the body of its una corda sound reappear when its strike point is moved 3/16" towards the capo bar. (Strange but true, the standard position strike point doesn't suffer 1/10th being moved to the new spot what the una corda suffers being kept at that standard shank length.)...Ah, but that's a story for another time...

Bill Ballard, New Hampshire Chapter

At Large

Secrets Of The Superglues

A.J. Hand

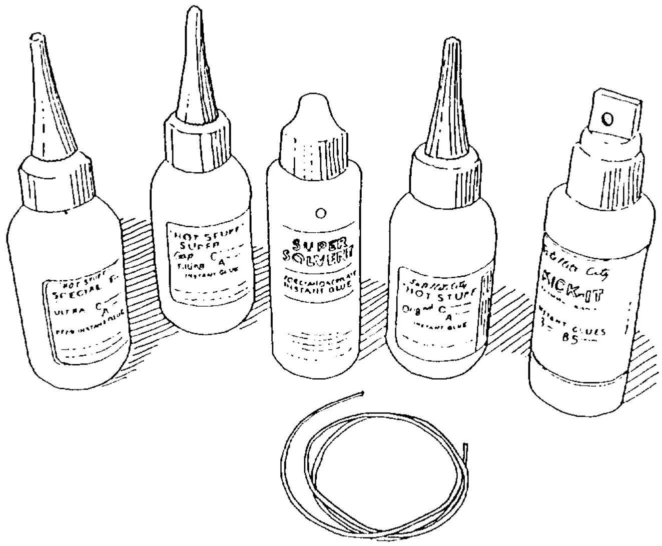


illustration by Valerie Winemiller

Have you ever tried one of those super-fast cyanoacrylate glues only to be disappointed by a weak bond or even no bond at all? If so, you are not alone. When those tiny tubes of revolutionary adhesive came out several years back, I tried them dozens of times on all kinds of materials and finally gave up in disgust. Sometimes they worked perfectly, but more often they failed miserably. And everyone I've ever talked to has had the same experience.

It doesn't have to be that way. About two years ago I stumbled onto a brand of cyanoacrylate that really works. This stuff comes in three different viscosities, and the maker, Satellite City, Inc., also offers a spray-on catalyst, or cure accelerator. With this superglue I started getting consistently good results. I talked to experts, learned more about these glues, and began getting even better results. Recently I've found other brands of high-quality cyanoacrylates. I've also learned the reasons behind those early problems.

Super Discovery

Serendipity played a starring role in the discovery of superglue. During Word War II, its inventor, Fr. Harry Coover (now president of Loctite Corp.'s new business development group), was a young chemist working at the Kodak Research Laboratories in Rochester, NY, looking for an optically clear plastic for gun sights. "I was working with some acrylate monomers that showed promise," he relates. "But everything they touched stuck to everything else. It was a severe pain."

1951 found Coover supervising a group of chemists at the research laboratories of Tennessee Eastman Co. Their mission: to find a tougher, more heat-resistant acrylate polymer for jet canopies. One of the group, Dr. Fred Joyner, spread a film of ethyl cyanoacrylate between a couple of prisms of a refractometer to check its refractive index. He made the measurement, but couldn't pry the prisms apart. "He came to me to report that he had ruined a seven hundred dollar instrument," Coover recalls. "It was then I suddenly realized that we had a unique adhesive." Years of work remained before cyanoacrylate became a viable product. Eastman 910, an industrial adhesive, was introduced in 1958.

Cyanoacrylates are reactive monomers that polymerize (chemically link) when pressed into a thin film — and only then. Under normal conditions "all surfaces have at least a monomolecular layer of water on them," Coover explains. "It's actually the water, or any weak base, that is the catalyst causing the polymerization."

The original cyanoacrylates were water-thin and good for gluing nonporous surfaces only: metal, glass, rubber, some plastics. Later, thickeners and other agents were added by some companies to adapt the adhesive for wood, leather, ceramics, and such.

All cyanoacrylates bond flesh well, as nearly every user knows. This generally causes no problem, for acetone (lacquer thinner or nail polish remover) will dissolve the glue and free your flesh. But beware of tots bearing superglue. A medical journal recently described the case of a man who had to have a plug of cyanoacrylate surgically removed from his ear. It seems his three-year-old son squirted in a glob of glue while daddy slept.

Trouble With Superglue

The problems most people have with cyanoacrylates are tame by comparison: merely poor or failed bonds. Why does this happen?

There can be many reasons. Sometimes the trouble starts in the plant. Bob and Bill Hunter, a father and son who head Satellite City, Inc. voiced the same opinion: "Inferior drugstore cyanoacrylates often are of poor quality to begin with.

"Most are imported from Japan or Taiwan, where some producers don't spend enough time in refining," Bob Hunter explains.

"If the cyanoacrylate isn't properly prepared, it will have a short shelf life," Coover elaborates. So the makers of the low-quality stuff add excessive stabilizers to keep it from curing in the tube. "The result is poor performance," Coover goes on, and he explains why: "The stabilizers are acidic materials. If the concentration is too high, it will overcome the catalytic effect of the minute amount of moisture on the substrate and nothing will happen. A lot of the imported materials perform well," he adds, "but those sold at the low end of the market have given cyanoacrylates a bad name."

"Somebody buys the inferior stuff to do a specific job, bonding things that are important," Bill Hunter laments. "The glue fails, and he gets the impression that CA (cyanoacrylate adhesive) is just for fun."

But good CAs — used properly — are not just for fun. They are used every day by hundreds of different industries. Museums soak brittle bones and fossils with the glue; it helps bind them together and give them strength. Burt Rutan used Satellite City adhesives extensively in the construction of his *Voyager*, the lightweight airplane that flew around the world (September '84)

CAs can have a tensile strength of 4,000 to 5,000 psi, or roughly four times that of white oak. Says Bill Hunter: "For all practical purposes it's overkill."

Glues To Choose

Some of the products you buy in the tiny tubes at the hardware or drugstore are fine for the quick repair jobs they're made to do. (Coover claims that his company's Duro Quick Gel is "technically the best one out there. It has an additive that makes it, in my judgement, foolproof.")

But the tiny tubes are not convenient for me: I use CAs too profligately. And they are not economical: I buy cyanoacrylate in one-ounce bottles for around $10. At my local drugstore, a tube containing 0.07 ounce costs $2.50. That works out to nearly $36 per ounce!

After working with Satellite City glues for over a year, I started running into other makers, all marketing CAs for the hobby trade, and like Satellite City, all offering various viscosities — in one- and two-ounce bottles — plus spray-on cure accelerators. Among these makers are Pacer Technology & Resources, Sig Manufacturing Co., PIC, and Carl Goldberg Models. Now (too late to be included in our photos) I've learned that 3M has joined the ranks. There may be others.

I tried some of these products around the shop, and for my purposes, they seemed to work as well as Satellite City products. Others have found significant differences though. When *Scale Radio-Control Modeler Magazine* tested the tensile strength of two cyanoacrylates for a piece it ran in its January-February 1987 issue, Satellite City's Hot Stuff came out on top, "... almost two times stronger on average than the brand with which it was compared," according to the article. In that test fiberglass circuit board was glued to itself. Fiberglass was chosen because it's a difficult test material: smooth, nonporous, and strong enough not to fail before the glue itself.

Nevertheless, when I spoke with the magazine's publisher, Norm Goyer, he pointed out that for most jobs around the home all the products named above serve him well too. Generally, the material being glued will fail before the bond does.

The moral of all this? For simple gluing jobs — involving wood, most plastics, rubber, etc. — any good CA should work. If you have a particularly difficult job — gluing metals or composite materials, for example — it may pay to choose your glue more carefully. Check to see if it conforms to Military Spec MIL-A-46050-C, or ask the maker for test data on the actual materials you plan to glue.

Use It Right, Too

Getting good results is more than a matter of buying a quality glue, however. You also need the right formula for the job you're doing, and you have to use it correctly. Rule one is this: Don't expect the water-thin cyanoacrylates to do every job. (Most drugstore brands, unless the tube says otherwise, will be this type.)

"With CAs," notes Tom Nightingale of Pacer Technology & Resources, "the gap-filling capacity is directly related to viscosity." You use the watery versions on parts that are smooth, tight-fitting, and relatively nonporous. These glues set fast; so when gluing a joint you must assemble the parts dry, then apply the adhesive around the edges of the seam. It wicks deep into the joint by capillary action and cures in seconds.

Because these CAs are so thin, they will not wick into loose joints, and they won't bridge gaps. They're not much good on porous materials either. They get soaked up before they can wick throughout the bond area.

That's where the higher-viscosity formulas come in. Makers offer medium viscosities (like syrup) and thick glues (like a mixed epoxy). These are thick enough to bridge small gaps and to resist being sucked out of the joint. You apply them to the surfaces first, assemble the joint. Consequently they have slower cure rates. The thickest usually take about a minute to cure.

But if you are using them on sloppy joints with wide gaps to fill, cure time may extend to minutes or even hours. This is one case where the spray-on cure accelerators are indispensable. Just mist a light coat on one of the mating surfaces. It will dry almost instantly, but remain active for several minutes. Apply your glue to the other part, then assemble the joint. The accelerator will normally kick the glue over in seconds.

In addition to different viscosities, Pacer makes special formulas such as Poly-Zap for bonding difficult plastics like polycarbonate and polyamide nylon, and Plasti-Zap which contains ingredients to overcome the mold-release agents often found on the surfaces of plastic model parts.

If you have specialized needs — and need large quantities — you might want to investigate the industrial lines of cyanoacrylates. Says Nightingale: "We have over one hundred different formulations and materials in the CA family."

For use around the shop and home, however, the three basic viscosities I've mentioned should be adequate. In fact, I find I don't have much use for the medium-viscosity materials. I either want the fast set and excellent wicking of the thin formulas, or I want the gap-filling ability and the longer assembly times of the thick formulas.

Sticky But Tricky

Cyanoacrylates are odd beasts. So sometimes, despite you best efforts, you may still have problems with them. Common causes are:

• Poor fit. even though thick formulas can fill small gaps, the better the fit, the better the bond. Always check mating surfaces before bonding. Smooth them up and remove any burrs or rough spots. Kickers help, but it's best to aim for a good fit in the first place.

• Too much glue. Never use more than necessary. According to Bill Hunter, "Optimum results are obtained with the minimum quantity of adhesive required to fill the joint. In general, one free-falling drop spreads over one square inch." It takes some experience to know how much glue is enough, so it's a good idea to experiment on scraps of your material — making joints, then tearing them apart to check coverage.

• Premature curing. Do not spread your glue before you assemble the parts. This encourages it to start curing. Instead, lay down a serpentine bead, then assemble the parts, letting pressure squeeze the bead out into a thin film.

• Premature stressing. Although CAs cure in a matter of seconds, this initial cure is only about 20 percent of full strength, which is only reached after eight to 24 hours. Give the bond ample time to cure before subjecting it to stress.

• Surface contamination. CAs are more tolerant of this than most glues, but they still work best on clean surfaces. Waxes, oils, and *excess* moisture can act as barriers between glue and substrate, and this can lower bond strength.

• Acidic surfaces. Since alkalinity triggers the cure, it's not surprising that acidity inhibits it. To solve this problem, you can use a kicker on one of the mating surfaces. These are essentially organic amines that "supply a heavy dose of alkalinity," as Bill Hunter puts it.

• Low shelf life. The Hunters recommend storing unopened bottles of CA in the freezer. Frozen, the adhesive should last at least two years. Once the bottle is opened, however, shelf life drops to about six months. Moisture in the air gets in, starts the curing process, and the glue gets progressively thicker until it is too gummy to use. They do not recommend refrigerating or freezing bottles that have been opened.

• Cold. Users who store CA in the fridge or freezer may take it out and use it cold. They apply it as usual, and the joint simply falls apart. What happened? "The polymerization is not terribly sensitive to temperature," explains Coover, "but when the glue is cold it gets thicker, and it may not get squeezed into a thin enough film to expose it adequately to the surface moisture it needs to catalyze."

Pet Projects

Although CAs will do just about any job other glues can handle, most often I find myself using them in unusual ways.

I use them almost daily in the home and shop for dozens of little odd jobs. The most common is tacking. A drop or two will tack a workpiece, a hinge, or a curtain-rod bracket in place so it can't skid out of position while I nail or screw it down. If work tends to slide around on my drill-press table, I tack it down.

To whip the end of a rope I soak it with glue and mist it with kicker. If I need to drive a screw in a tight or awkward spot, I tack the screw to the tip of my screwdriver so I can work one-handed.

Bill Hunter has used CA as a wood finish on both his kitchen table and the walnut instrument panel of his Sunbeam Tiger. His technique? Dribble Hot Stuff (Satellite City's thin formula) on the wood, spread it around with a business card, then mist lightly with kicker. Sand lightly with fine paper on a block. Then repeat, applying two or three coats. You can get a matte finish by rubbing with steel wool, or use polishing compound to achieve a high-gloss. A complete multi-coat job takes less than half a day.

Using CA with kicker opens up a realm of possibilities. You can lay a thick bead of the viscous stuff and spray kicker over it to create a neat fillet along a seam. By alternately applying glue and kicker you can build up acrylic plastic to any shape you like. A fishing fanatic, I use this technique to build plastic-bodied flies.

The only way you'll ever realize the full potential of CAs is to buy some and have them on hand. I'd suggest a bottle of the thin stuff, a bottle of one of the thickest formulations, and a spray bottle of kicker.

You aren't likely to run into one-or two-ounce bottles of CA in the local drugstore. I've seen these products in hobby shops (model makers love it), but I usually turn to mail-order catalogs aimed at model makers and woodworkers. If you have special needs or questions, or have trouble locating the adhesive you want, contact the manufacturers directly.

Some manufacturers of super glues: Carl Goldberg Models, 4734 W. Chicago Avenue, Chicago, IL 60651; Loctite Corp., 4450 Cranwood Court, Cleveland, OH 44128; Pacer Technology & Resources, 1600 Dell Avenue, Campbell, CA 95008; PIC, 943 North Shoreline Boulevard, Mountain View, CA 94043; Satellite City, Box 836, Simi Valley, CA 93062; Sig Manufacturing Co. Inc., 41-7 South Front Street, Montezuma, IA 50171; 3M Co., 3M Center, St. Paul, MN 55144.

Tuning Up

Stability

Rick Baldassin, RTT
Tuning Editor

The subject of tuning stability has particular meaning to me at the moment as I have just spent the week tuning for Garrick Ohlsson. Those of you that have tuned for him know why I say this. For those of you who have never met him, let me give you some background. Mr. Ohlsson is a very large man. He stands about 6'4", and wears a size 54 long coat. He plays the piano with tremendous force, yet has as lovely a tone as I have heard. I have tuned for him on several occasions, and each time it seems to be a contest who will win — Rick and the in-tune piano, or Garrick and the out-of-tune piano. His purpose, of course, it not to knock the piano out of tune, but to make beautiful music. So the contest, you see, is really between myself and me.

I firmly believe that the true test of whether one can tune with stability or not should be to have Garrick Ohlsson play a Rachmaninoff Concerto after the tuning. If the instrument is in tune at the end of the concerto, then stability has been achieved, and you can rest assured you will never have a problem with anyone else you will ever tune for.

With the stage thus set, let us explore some of the things which I did to keep the piano in tune during the past week.

Mr. Ohlsson plays the Bösendorfer piano, and the Imperial Concert Grand arrived Monday around noon. The first rehearsal would be Tuesday morning. I arrived early Tuesday, to tune the piano before the rehearsal. The instrument seemed to be fairly well in tune and at pitch, but the sixth and seventh octaves were a little low, maybe as much as four cents. Time permitted only one pass on the tuning. I stayed for the rehearsal, and by the end of the concerto, the treble was really out of tune. Why? The treble notes were too far out of tune to create a stable tuning in one pass. If time had permitted, I should have gone over the treble twice, once to get it very close, and again to make it stable. Fortunately for me, this was just the rehearsal, and not the performance. Also, because the instrument had just been moved to Symphony Hall, there was a certain amount of instability present in the structure of the instrument. This simply exaggerated the situation.

There are two important lessons to be learned thus far: 1. The piano cannot be tuned with stability if it is not (literally) in tune to start with. In this case the treble being flat by only four cents proved to be too much; 2. Instability in the structure of the instrument must be released before the final tuning, or it will release itself while the instrument is being played. It is impossible to tune the piano when it is in an unstable state.

The next morning, I came again to tune the piano before the rehearsal. Mr. Ohlsson had practiced during the previous afternoon and evening. I noticed many more false beats than I had the day before. Seating the strings on the bridge solved the problem. But I had seated them just the week before! The lesson to be learned here is that hard playing drives the strings up off the bridge, and if the piano is tuned while the strings are sitting wedged between the bridge pins and not sitting on the bridge, the tuning will never be stable.

The first performance was Wednesday night. I came to tune the piano later that same day, on Wednesday afternoon. I found that the piano was finally staying in tune, except for a few notes that had bad unisons. In most cases, it was simply one string that had drifted from the other two. Before I started the tuning, I worked with those individual strings to eliminate the instability which existed in them. In some cases, the cause was again that the string was not seated on the bridge. In most cases, however, the cause was excess friction at the capo bar. While tuning these notes, a "ping" could be heard as the string was being rendered under the capo bar. The time was too close to the concert to move the strings sideways. This would create additional instability. Instead, I elected to tune these strings while pounding very hard, until I was sure that they were going to stay. I knew which notes were likely problems at this point, and I simply gave them extra attention. A couple of years ago, concert artist Charles Rosen made the following statement to me, "Better a Devil that you know, than one that you do not know." This applies here. If you know a note has a tendency to go out of tune, you spend extra time making sure it doesn't.

By the time the piano was being tuned for this concert, it was the third tuning in two days. As you can imagine, almost all of the piano was already in tune. One of the most important keys to tuning stability is that if you come to a note that sounds in tune to start with, and you give it several hard test blows, and it then still sounds in tune, leave it alone!! Even if you move the note, then move it back exactly where it was, it will not be as stable as if you had simply left it alone. Our human tendency is that we can always make something better than it already is, and therefore we have trouble accepting the fact that in this case, things may already be as good as they can be. We may also have the concept that the customer is paying us to tune the entire piano, which means we must move every string to make it in tune, possibly out of fear that if the customer senses that our job is too easy, we may not be called upon as often. Just remember this — the customer is not paying you to tune the piano, rather to insure the piano is in tune when you are done.

Some time ago, I sought help for a back problem from a chiropractor. During my first visit, he put me through some diagnostic maneuvers to isolate where the problems were, then he adjusted those areas. Upon telling me we were through for the day, I asked him if he wasn't going to adjust my lower back. I had been to different chiropractors before, and they always adjusted my neck, upper back, and lower back. I figured if I was paying him for an adjustment, he ought to give me a complete adjustment. He replied that my lower back was in adjustment, and there was no need to move it, because if he were to adjust it, it would be less likely to stay in position, even if he adjusted it right back where it started, because he moved it. I thought about that for a while, and decided that the same principle applies to tuning stability. Tuning stability is more complicated than the fact that we are manipulating the tension of the wires. We can start at a given tension, change the tension, and put the tension right back where we started, and the note will be unstable. Why? Because the wire passes through several friction points, and is not in a straight line, but is bent in several places. When we change the tension it moves these bends through the friction points, and it is possible to leave the wire at the same tension (pitch) and not have the bends in the same places. For this reason, we have undermined the stability of the note.

The object, then, is to do the tuning while moving as precious little as possible. If you have to move any note very much, you had better check it again later. After completing the tuning, depress the pedal, and with both hands slap the keys very hard, up and down the keyboard several times. This usually draws quite a reaction from the stage crew. They always knew piano tuning would drive you insane, and now they are assured it has happened. After the roar has subsided, carefully listen to each unison and see if any has moved. If any note has moved very far, or if several notes have moved, your tuning may not yet be as stable as it needs to be. When you can perform this test and very little needs to be adjusted afterward, you will have achieved a stable tuning.

The steps to create a stable tuning are as follows: 1. The piano cannot be out of tune and be stably tuned for a concert in one pass; 2. Any instability in the structure must be relieved before the piano is tuned; 3. The strings must be seated on the bridge before the piano will stay in tune; 4. Give special attention to any problem notes you may come upon during the process to insure they settle down; 5. When tuning, only move the strings that are out of tune, and leave the ones that are in tune alone; 6. Depress the pedal and forcefully play the keys several times, exposing any notes that are not stable; and 7. Make sure any final movements are very small.

Even though the piano in this case was brand new, it stayed in tune through each of the three concerts. As you can see, however, it took a lot more work than showing up one day and giving the piano a quick touch-up. The above procedure is how tuning stability is achieved at the concert level. To some degree, the above principles also apply to our every-day work. If the piano is very far out of tune, it will need a pitch raise to make the tuning stable. Make sure the structure is stable when you tune, and the environmental conditions are favorable. Strings which are not seated on the bridge will not stay in tune. Avoid moving the pins back and forth, only to leave the note where you started, either to convince yourself that the note is correct, or that your customer is getting his money's worth. Depress the pedal and play the piano forcefully, then make any minor corrections as needed.

Stable tuning is the result of proper hammer technique, as well as proper string settling technique. Neither technique alone will work. I have observed the extremes of both techniques alone, but never with satisfactory results. I have found through experience that tuning with repeated hard blows while moving the tuning pin works better for me than moving the pin while playing with soft blows, then testing with a hard blow. The repeated hard blows allow you to actually quit tuning the note when it is in tune, rather than anticipating how much it will drop when the test blow is given (and starting over). Also, the closer the piano is to being in tune, the less hard the blows need to be. In addition, if the final pin movement is very small, it does not really matter if the movement comes from above pitch, or below pitch.

If you question any of the above principles, remember that I learned them, in part, in the "Garrick Ohlsson School of Tuning Stability" and I passed the final exam.

The remainder of this month's column consists of articles and letters with my responses on the subject of tuning stability. Several of these were cited in the "*Journal* References" at the end of this month's article on passing the tuning examination by Michael Travis.

The Solid Unison

The following is an excerpt from a letter from Richard Davenport, of the Los Angeles Chapter, which originally appeared in the August 1987 issue of the *Journal*. Richard writes:

Whatever happened to "the solid unison?" When I first learned to tune, my most vivid memories are associated with tuning a perfectly tempered octave. I would spend hours on my inexpensive spinet striving for the perfect temperament. After three months of intense practice, I had not only mastered the temperament, but was a world-class tuner in the treble and bass. I'd worked hard, and my tuning time was down to about three hours. The piano was perfect!

It was on a nice autumn day that the whole picture changed. I had just completed another perfect piano tuning for a local dealer. My teacher, Fred Odenheimer, was in the store, and I decided he should have the pleasure of listening to my latest creation.

"That's very nice, Richard," he said as he delicately checked my intervals. Then, without warning, Wham! Wham! Wham! Wham! In 15 seconds, he had totally destroyed my work of art. "It's no good if it doesn't stay," was the message I received. Upon careful examination, it wasn't the octaves. It wasn't the thirds, fourths, fifths, or sixths. It was the unisons that bothered me most. (Stable) unisons are not only the most difficult intervals to tune, but are the most important....

For the past four or five years, I have been fortunate to work on some fine concert instruments and follow some fine concert tuners (few were technicians). The one common denominator is solid unisons. There is one local man who stretches the treble to the point where C8 is at the pitch of D#. Yet he is very successful because he tunes clean solid unisons. I'm convinced that solid unisons throughout the piano are the standard by which good tunings are judged....

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The solid, stable unison does indeed seem to be the standard by which the public judges good tuning. The unisons are the first aspect in which the public detects out-of-tuneness. I feel sure that a customer would be more happy with a fair temperament, acceptable octaves, and rock solid unisons, than with a superb temperament and octaves, and unisons which were out of tune in a few days. I can assure you that spending an extra ten minutes going over the unisons one more pass will buy you more than an extra hour on the temperament. Am I downplaying the importance of temperament and octaves in fine quality piano tuning? Certainly not. My father always taught me "Rick, you have to learn to do first things first." In tuning, the solid unison must most certainly come first.

The Torture Test

The following is a letter from Jim DeRocher, of Spotsylvania, Virginia, which originally appeared in the August 1987 issue of the *Journal*. Jim writes:

I would like to write concerning a technique I use to settle the piano very firmly after the initial pitch raise. I do this by depressing the damper pedal and playing fortissimo octaves in each hand all the way up and down the keyboard several times. This really gets the soundboard shaking and the piano hopping up and down. (In fact, if the customer isn't around, instead of octaves I use both forearms to really shake things up). This insures that all tensions are equalized across the soundboard and that there is no roll left in the bridge. This technique has been so successful for me that now after each regular tuning, I give the piano this "torture test" in order to reveal any unisons that haven't been perfectly settled. It is my thinking that in this way I give the customer as rock-solid a tuning as I possibly can. I figure if my banging doesn't cause much drift, little Susie's delicate pinkies won't knock the piano out of tune either.

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I know to some of you this sounds most cruel, but beside Susie's pinkies, there are a lot of "Popeye arms" out there, too. I remember going to a recording studio with Norm Neblett some time ago. He spent most of his time tuning the unisons (of course, the piano gets tuned nearly every day). After tuning unisons for a while, he stopped. I figured he was done. Then he took his hands (each one covers about a twelfth) and proceeded to "slap" up and down the keyboard. I figured he was crazy. When he was done carrying on, he listened to the unisons again carefully, even more carefully than before, fixed a few, and we left. I learned one of the most important lessons of my career. Thanks to Jim for his confession about the forearm smash.

Some Thoughts On Stable Tuning

The following article by Daniel L. Bowman, of the Richmond, VA, Chapter appeared originally in the February 1989 issue of the *Journal*:

The following is the result of further thought and refinement of the ideas I was trying to communicate in a technical on solid tuning which I presented to the Richmond Chapter.

I was talking about that zone of mushy, dragging springiness you feel in the tuning pin and string system when moving the tuning hammer in either direction before the pin actually turns in the wood. A good word handle for that phenomenon now comes to me — "The Marshmallow Zone." The two main characteristics of this marshmallow effect are "springiness" or flexing in the total pin/string system apart from any real movement of the pin in the wood, and "friction" which in varying degrees conceals the fact that the pin/string unit may be in a flexed or sprung state rather than a stable state. This "springiness amidst friction" is found in some degree or other on all tuning pins that are not too loose to tune. It is caused by the interplay between the friction in the wood holding the pin, twisting and bending of the pin above the hole and also down in the hole, and unequal stretching of the string across its various segments due to friction at the string's bearing points. Coping with this "Marshmallow Zone" as the pin is rotated in either direction is what calls for professional level skill on the part of the piano tuner (to say nothing of the problems of pitch, temperament, inharmonicity, etc.).

The first step in setting a solid (stable) pin/string is to push/pull/bump/jerk/impact the pin through the "Marshmallow Zone" and get actual rotation of the pin in the wood. If you do not get movement in the wood, even though you have achieved a pitch change, you have only sprung the pin/string unit out of its natural resting state, and hence the unit is unstable. The friction in the "Marshmallow Zone" will hold the pin/string unit in that sprung, unstable state, but only for a while — plenty long enough to fool you; perhaps long enough for you to get out the front door, or maybe even for a week or so, or just until the next hard hammer blow. When you move that pin in the "Marshmallow Zone" without movement in the wood, you have changed the balance of forces between the pull of the string and the stiffness of the pin without giving a foundation or support for a new resting place. The new support is the new position of the pin in the wood into which it can then settle, or rather be settled.

The second step after getting this new position in the wood is to actively settle the pin/string unit back into its new resting place. Remember, when you finally did get movement of the pin in the wood, you first passed through the "Marshmallow Zone" and introduced a sprung condition into the pin/string system. The friction in the "Marshmallow Zone" will keep this sprung condition from automatically correcting itself when you release the tuning hammer. You have to actively *feel out* where in the "Marshmallow Zone" the sprung forces are relieved and help the pin/string unit settle into that exact spot. Mentally keeping track of how far the pin/string unit sprung before the pin moved in the wood helps you more quickly locate the new resting place. The resting place is the point at which all sprung forces are out of the pin/string system leaving a balance of forces between the pull of the string (with tension equalized over its entire length) and the stiffness of the pin. I stress again that you must actively take charge of locating the new resting place and help the pin/string unit settle into this place, the place where it wants to settle, but cannot because of the Marshmallow's friction.

An essential element in this settling procedure is a healthy banging of the key in coordination with tuning hammer movements to insure complete freedom of string rendering across the various bearing points.

It seems to me it is the skill of feeling out the new resting spot and actively helping the pin and string settle into it, which is one of the more difficult solid tuning skills to learn. The consistency of the "Marshmallow Zone" — the amount of springiness and amount of friction — varies from piano to piano, and sometimes from tuning pin to tuning pin. Sometimes the new resting place is sharply defined and easily located. Sometimes the "Marshmallow Zone" is so broad and the friction in that zone is so high it seems possible to set the pin in a range of places and make it stay. I am always uneasy in those cases; surely there must be be some instability left in that setting. As my skill has increased, I am finding less difficulty in finding "the spot" even in those broad, high friction "Marshmallow Zones" and then settling the pin to that one spot — and also ending up on pitch! This is the great skill we are talking about here, and great fun!

Beginning tuners are often advised to learn to make tuning movements in tiny increments. Note that tiny increments of pin movement in the wood are not the same as tiny increments of pitch change. Your effort should be directed at getting tiny increments of movement of the pin in the wood; the pitch of the string may, depending on the consistency of the "Marshmallow Zone," have to fluctuate widely before that tiny movement in the wood is achieved. Do not let tiny increments in pitch change trick you into just tuning in the "Marshmallow Zone" without pin movements in the wood.

The trick, then, to solid tuning is to make sure you push/pull/bump/jerk/impact the pin all the way through the "Marshmallow Zone" (in either direction) to the point of actual pin rotation in the wood followed by actively settling the pin/string unit back into its new resting place somewhere in the midst of the "Marshmallow Zone." If you do not get that movement in the wood, followed by an active settling-back, your tuning will be unstable.

Setting The String

The following letter comes from Norman Neblett of the Los Angeles Chapter, and appeared originally in the April 1989 issue of the *Journal*. It was in response to the article entitled "Some Thoughts on Unstable Tuning" by Daniel Bowman, which appears above. Norman writes:

Daniel Bowman refers to the "mushy, dragging springiness that you feel in the tuning pin and string system when moving the tuning hammer in either direction before the pin actually turns in the wood." He calls this phenomenon the "Marshmallow Zone." He correctly describes this as being caused by pin friction, pin twisting, and string friction at the bearing points.

His belief is that the pin must be put in its natural resting place, which is a new position in the wood. This is only part of the technique to accomplish stable tuning. When it comes to tuning stability, setting the string is of primary importance. Without touching a tuning pin, it is the string movement that alters pitch. It is the string that has to be settled, not equalized, to make the tuning stable. It has often been assumed that the string tension is equalized over its entire length. This is virtually impossible due to the forces that lock the string in place: i.e. bearing points in the string segments, understringing felt between the capo, agraffe, bearing bars, and tuning pins, and steep upper bearing bar and agraffe string angles. I used to believe the idea of equalized tension until it was proven incorrect by technicians such as Jim Coleman, Sr.

So how do we set the string? The string is driven into stable position with blows just as it can be driven out of position by blows if the environment is unstable. The tuning pin is essentially a spring threaded in a hole. It is under many tensions, and has a memory to which it tries to return. The tuning pin acts as a medium to get the string close enough to be driven into place. When close, pressure is applied up-pitch or down-pitch on the tuning pin, and the string is then literally shocked into position with heavy blows to the key. It is then tested the same way without any pressure on the tuning hammer. If the pitch stays, great! If not, you are forced to start over again.

There are some other points to remember. Use a heavy tuning hammer with a tip that fits the pins tightly. A worn tip is useless. If the humidity is changing within the piano when you tune, it will not tune well or stay in tune. A piano which is way out of tune requires two tunings to be stable. For high level work, a piano must be in tune before it is tuned. The more you move the tuning pin, the more unstable the tuning. This is the nemesis of beginning tuners. They cannot move the pin in fine increments. They are inept at settling the string with key blows, and they create tuning instability with too many pin movements.

The most important tuning in a piano is unison tuning. Unison errors are easily discerned by both untrained and trained listeners. Unisons are the first to go out of tune. During the tuning process, if a unison is in tune, do not move the tuning pin. Merely give the note a test blow, and if the unison stays, go on to the next note.

The above are basic principles. Refined tuning skills need to be taught privately and practiced. Bad techniques are hard to change. Remember that tuning and listening skills emanate from the brain, not the tuning hammer. The tuning hammer should never be moved unless the tuner knows which direction he needs to move it. Electronic tuning devices are helpful in this area as they tell you which way to go.

Each of our readers has a unique opportunity through PTG at the Annual Piano Technicians Guild Convention, where tuning is taught by recognized leaders in the field. I encourage each of you to take advantage of this opportunity, whatever your skill level.

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Our thanks to Norman for his response. Tuning stability is a combination of good hammer and string settling technique. Jim Coleman has taught that it is necessary to move the bottom of the tuning pin in the hole. He has demonstrated this by devising a tuning pin which protruded from the bottom as well as the top of a pinblock. He attached pointers to both the top and bottom of this pin, and these pointers met at the side of this piece of pinblock. With this device, he was able to demonstrate that moving the top of the pin did not necessarily move the bottom, and when the bottom did move, the pointers no longer lined up. This showed that there had to be a settling back of the top of the pin to make the pointers line up. This is true no matter which way the pin is turned. If we do not settle the pins back, eventually the pin will settle itself back, causing tuning instability as the result of poor tuning hammer technique. Moving the top of the pin without moving the bottom is what Daniel Bowman describes as the "Marshmallow Zone." He advocates that once the entire pin has moved, we must "actively settle the pin/string unit back into its new resting place." This essentially makes the "pointers line up" as in Jim Coleman's demonstration.

In addition to the tuning instability caused by poor hammer technique, there can also be instability caused by failing to properly set the string with hard blows, as Norman has stated. Daniel made reference to this when he stated, "An essential element in this settling procedure is a healthy banging of the key in coordination with tuning hammer movements to insure complete freedom of string rendering across the various bearing points." If the string is not settled properly, it will eventually creep across the bearing points on its own, causing tuning instability. Worse yet, during the first hard playing, the string settling which should have taken place during the tuning process will occur. The result is a freshly-tuned piano which has immediately gone out of tune. Most customers do not like this.

The trick in all of this is to leave the tuning pin in a stable state, with the string properly settled, and at the proper pitch, all at the same time. Do not be tempted to make a final pass to clean up the unisons with hammer technique alone. This, of course, makes the job easier, but will result in unstable unisons after a short amount of playing. The other trap is to try to accomplish too much with the hard blow. The temptation, when the pitch is high, is to give the note a hard blow to drive the pitch down. Once the desired pitch is achieved, these hard blows are discontinued. We must be sure that if one hard blow put the note where we wanted it, another will not drop it too far. Note that Norman stated a hard blow should be applied both with pressure on the tuning pin to change the pitch, then again with no pressure on the tuning pin to see if the pitch stayed. Bill Garlick advocates another hard blow with the tuning hammer removed from the pin, to exaggerate this point.

In addition, there seems to be something about several notes being played hard at once during performance which is different from each note being played hard individually during the tuning process. If you really want to know if the tuning is going to stay, depress the damper pedal, and play fortissimo octaves with both hands up and down the keyboard, or slap several notes at a time with both hands in like fashion. Chances are that few unisons will slip out of tune. Go back and re-tune them. Better now than later. Finally, Jim Coleman warns of the tendency to pound too hard in anticipation of a concert artist, as this can result in the pitch of the piano creeping sharp after tuning.

In conclusion, it is a combination of good hammer technique and string settling technique which make a stable tuning. Our thanks to Jim Coleman and Bill Garlick for their input on this subject.

The Test Blow

The following excerpts come from a letter from Ken Burton, of Calgary, Alberta, which originally appeared in the December 1989 *Journal*. Ken writes:

I have a question which is troubling me.... The issue is "pounding" or the tuning blow. I have always felt that if my hammer technique is good, heavy pounding is unnecessary. But, lately, I have run into a couple of good tuners who advocate unmerciful pounding. One showed me with his Sight-O-Tuner that after I had set a string on an older grand, he could knock it down.

If this issue has not been explored, the modern tuning devices should be helpful in measuring what happens in some string segments with heavy pounding.

I presume the segment which most concerns us is the tailpiece between the hitch pin and nearest bridge pin. How many cents over pitch does the string have to be pulled before the tailpiece comes to its proper tension? Is heavy pounding the only way to equalize tension? How can an aural tuner know when this has happened? How does this factor change with different pianos? What happens of rotary or bending pressure is exerted on the pin during the tuning blow? Is this a desirable practice?

One technician told me that in the Yamaha factory, they taught him to pull the note sharp, then, exerting a very small counterclockwise force on the hammer, to heavily pound the note down into place. He recommends this as a fast way of tuning which stays solidly in tune. Is this right?

For me, this is not an academic issue. I am intent on learning the best way to tune aurally and will adopt this unpleasant practice if it is demonstrated to be the only way to achieve tuning stability. Thank you for your help.

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Concerning the tuning blow, I suggest you read "Some Thoughts on Unstable Tuning" by Daniel Bowman, February 1989 Journal, and "Tuning Up" by Rick Baldassin, April 1989 *Journal* (both reprinted in this issue). These articles deal with issues of hammer technique and the test blow. I have never performed any studies as you propose, by measuring various string segments. My experience has shown that the tail segment is effected very little by normal tuning. A gross change in the speaking segment must be made for the tail segment to move at all. When we tune, we primarily manipulate the tuning pin-agraffe segment, and the speaking segment. The object is to leave these two in a stable state. This can be done by neither hammer technique or test blows alone. A combination of the two is necessary. My experience has shown, however, that the smaller the pitch corrections being made, the less hard the test blow need be. Steady hard blows seem more effective than several soft blows, followed by a "merciless" blow. The combination of hard blows with simultaneous hammer movement seems to work best. I try to overshoot as little as possible, making the pitch adjustments as small as possible. This is why it is more efficient to go through the piano twice quickly, than once meticulously. The electronic tuning aid is of great help in determining tuning stability. With the use of the aid, the tuner can learn what combination of hammer movement and test blows give the best stability. Once this combination is learned, it can be re-created by tuning, for instance, the unisons by ear alone.

Your concern for tuning stability is very legitimate. It is the most important aspect of tuning.

Until next month, please enjoy Michael Travis' article on stability as it relates to the tuning exam. Please send your questions and comments to:

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Friction

Alan Vincent, RTT
Young Chang America
Los Angeles Chapter

Friction is the most inconsistent, difficult to measure and variable factor contributing to touch weight. Excess friction can develop at many points in the action and key and these must all be checked in the course of addressing a touch weight problem. Friction is also the only factor which is constantly changing without the help of the technician. As a piano is used, the key bushings and action centers become loose due to wear. Since the felt bushings are not pressing as firmly against the pivot pins the result is less measurable friction within the key and action part assembly of each note. If an instrument is exposed to excess humidity, then the friction within the action assembly will increase as the wood and felt parts expand due to moisture absorption.

As we discussed in the first of these articles, friction is defined as the resistance to movement between two bodies when those bodies are in contact with each other. The amount of friction present at this contact point is determined by the following three factors:
1. Surface condition
2. Surface area
3. The amount of pressure forcing the contacting bodies together.

Any change in these factors will result in a change in the friction present.

Many touch weight complaints are caused by excess friction. Besides the effects of humidity, this excess friction could also be caused by the excess weight of an action part (probably the hammer) or by a leverage misalignment. When servicing a touchweight problem, any excess friction which may exist should always be eliminated prior to addressing other possible causes.

The points of contact on the grand action are listed below. Excess friction can occur at any of these points: front rail bushing; balance rail bushing; balance rail key hole; bottom of key to balance rail felt bearing; capstan to wippen contact point; wippen flange center;jack to knuckle contact; knuckle to repetition lever contact; shank flange center.

The above are considered during the travel from the resting position of the key and hammer until the contact of the jack tender to the let-off button and the repetition lever to the drop screw. At this point in the key travel (the beginning of escapement), several frictional points are introduced which were not in effect previously. A considerably greater weight would be necessary to propel the key past this point and onto the full completion of its travel than was required to move the key to this point. This is the reason that touch weight measurements are taken from the resting position of the key and hammer to the point of let-off. The escapement portion of the key and hammer travel occurs during the last 1/8" of vertical movement by the hammer. Since this is approximately the final six percent of the hammer travel, the hammer/key/action part assembly is moving with considerable inertia and the added frictional resistance encountered at escapement should not be felt by the pianist (of course, this would be dependent on the velocity of the blow, proper action regulation and good knuckle condition).

At the beginning of escapement, the following frictional points are considered; jack center; jack to knuckle contact; knuckle to repetition lever contact: repetition lever center; drop screw to repetition lever pad contact; jack tender to let-off button contact.

As illustrated, frictional excesses can occur at many different points within the action. Any increase in friction within the key/action assembly will result in a measurable change in the touch weight. If excess friction is present during the weigh off process and unnecessary lead weights are used to achieve a desired down weight, both an incorrect down weight/up weight relationship and poor weight placement will be the result. Examples of this situation will be detailed in future articles.

The use of lubricants is common within the piano service industry. A lubricant reduces friction by changing the surface condition present between the two contacting bodies. The technician should be cautioned against the use of an unknown lubricant on the action centers or key bushings. If possible, always check with the manufacturer before applying a lubricant to a Piano action.

The author has used the following lubricants with success:

VJ Lube (Vaseline, talc and lanolin) — This is used for trapwork pivots, pedal springs, action return springs and other relatively heavy metal members. VJ Lube should never be used on action parts or key parts such as the capstan screws and keyframe pins. The application of this lubricant on the small parts of the action and keys will result in an increase of the friction at these points.

Talc — Used for keybed/keyframe contact point lubrication and for knuckle lubrication.

WD-40 — Used only for rusted pedal prop bolt nuts and other metal members. This should not be used on action centers.

TFE lube (3M brand name) — This is a teflon based spray and can be used on keyframe pins. There are many teflon based spray lubricants on the market and most are suitable for keyframe pin lubrication. This also should not be used on action centers.

Action centers have been lubricated with many different substances.

One of the most popular has been a silicon/naphtha solution. Opinions differ among technicians as to the long term effects of this treatment on the action centers. One American piano manufacturer has used this solution for many years in their factory to reduce friction within the piano action centers. Care should always be used when working with silicon as it will cause extremely serious problems for refinishers. Silicon will stay on your hands and tools for a very long time, transfer from one item to another and will cause a finish not to adhere to wood. Several of the major piano manufacturing companies will not allow silicon into their factories because of the problems it could create.

The service technician should keep in mind that it is always preferable to repin rather than use a lubricant or shrinking solution on the action centers. The much used methanol and water mixture is a shrinking solution and not a lubricant. This can be effectively used provided the action center bushing cloth has not been contaminated and waterproofed by oils from inappropriate lubricants. The technician should remember that the use of a shrinking solution affords limited control over the consistency of the resulting action center torque. Always follow the application of the shrinking solution with heat from a hair drier or heat gun.

Next month, we will begin to discuss the basic leverage principles within the grand piano action. In future articles, we will discuss the 5:1 ratio within the grand action, inertia and its effect on touchweight and hammer weight as it relates to friction and inertia.

Bridge Recapping: Removing The Old Cap

Nick Gravagne
New Mexico Chapter

After a pattern, or rubbing, has been made of the old bridge top, and other pertinent information has been recorded and stored, it is time to remove the original bridge top. Whether this top is a cap or simply the top surface of a solid-body bridge the techniques and tools for bridge top removal are essentially the same. Once in a great while a cap is in such a fantastic state of dilapidation that it has virtually fallen off, the only force preventing it from actually doing so is the holding effect of the bridge pins. But take them out and administer a few whacks with a chisel and off comes the cap — piece by piece, maybe, but off it comes, effortlessly. Ah, how nice it is on occasion to live in the Land of Oz. But back in Kansas bridge caps can be as stubborn as an ox. There may exist a multitude of splits at the bridge pin holes, and there may be any manner of deterioration in general, but for some ungodly reason most caps are seriously determined to go down with the ship, only to be dissuaded by an equally serious piano technician aided by a vicious gang of hand and power tools.

Usual methods of bridge top removal include routing, planing (both with hand and power plane), chiseling, and power sanding. Of these methods, routing, for reasons which will become apparent, is perhaps the most common technique as well as the most popular with technicians. For the sake of this and future articles we are assuming that the bridge and soundboard are secured to the piano, i.e., the soundboard is not being replaced, which means that all bridge work must be accomplished while the original soundboard is glued to the case. Soundboard installers work at an advantage when undertaking a bridge recapping since they are uninhibited by rim obstruction; in addition, the original bridge is considerably handier to work on when it is off the old soundboard.

We are also going to assume that there are two methods of securing downbearing relative to bridge recapping. One is simply to duplicate the existing height of the original bridge, or to increase or decrease the original bridge height dimension in order to increase or decrease downbearing as the case may be. This approach does not necessitate using the plate for setting the bearing after the rough (un-notched) cap has been glued on. The second method of setting bearing on the new cap *does* require use of the plate. These approaches will be developed in future articles.

The reason they are mentioned here at all is because the new cap thickness may play a role to some extent in the decision making process of cap removal. It should be understood that no matter how downbearing is accomplished the job of bridge top removal is less trying on body and tools if the smallest practical amount of bridge material is removed. Now obviously enough material must be removed to some plane below the notches, and if the bridge top is a cap, the entire cap should be removed. But it really isn't necessary to go beyond this. However, it is difficult-to-impossible if, say, having removed a mere 1/8" of bridge top in the high treble, to then make a 1/8" thick cap for replacement. Working the new cap material to such a thin piece can be very tricky, and depending on the woodworking equipment at hand (thickness planers in particular) not possible at all. It is easier in the long run to simply remove more bridge top, a minimum of 1/4 to 3/8", and to make a thicker cap. This would be typical and desirable if the new cap is going to be made and downbearing set without the aid of the plate (i.e. simply by duplicating the original overall bridge dimension). On the other hand, if the plate is going to be used to set bearing then less material can be removed from the old bridge and a taller than necessary rough cap glued on. This presents no problem since the too-tall cap will be reduced back to a thinner cap *after* it has been installed. This is considerably easier than trying to work up a thin cap *and then* gluing it on. In any case I think that any new cap should be at least 1/4" thick if for no other reason than notching such a cap presents no danger of cutting through the cap and glue joint down into the bridge body. But thinner caps do exist on some first-rate pianos. This consideration of new bridge cap thickness will become clearer as these articles progress.

For now our attention is primarily on bridge top removal, and we'll consider the simplest technique first, assuming it will work. The bridge pins will have been pulled out and miked for size when the pattern was made. Now if the old bridge is capped it is sometimes possible to chisel the cap off if the glue joint is not exceedingly strong. Chiseling off a cap is generally more effective in the higher sections of the scale because the cap grain is usually running at a different angle than that of the body, or the fiber orientation of cap to body is not identical (especially true in Steinway-type bodies which are made up of vertical laminations topped off with a relatively thin cap). Actually this technique breaks the glue joint by cracking it open rather than by slicing through wood fibers.

Chiseling Caps Off

The technique begins by using an ordinary but very sharp 3/4 to one inch chisel with a mallet (or hammer) to make a vertical, cross-sectional cut that goes right through the cap to the glue joint. If the cap is thick use a small saw to make this cut. Make this first cut anywhere along the length of the cap in question but perpendicular to the running length of the bridge. Don't worry if the chisel cuts a fine line across the bridge body. Next, at a location two inches or so from the vertical cut, start chipping away at the *top* surface of the cap but in the direction of the vertical cut. The idea is to work a slope down to the glue joint (but not below it). Try to get a footing; that is, chisel out this slope where a definite view can be had of the cap cross-section as it sits on the bridge body. This cross-section will be seen where the initial vertical cut (down through the cap) was made. When this is clearly in view place the chisel *bevel side down* on the bridge body with its chisel point set at the exact underside (glue joint plane) of the cap and strike the chisel handle to see if the cap will sort of "peel" off piece by piece. Sometimes this technique will work along the entire bridge cap while other times it will work only at certain sections such as the two highest treble. It is usually necessary to re-establish fresh footings here and there beginning with new vertical cuts.

It is generally inadvisable to begin chiseling off a cap, or to chisel off an entire cap, by placing the chisel point right at the glue joint *but at the side of the bridge.* Such a practice will leave a wedge-shaped indentation in both the side of the cap and the side of the body. This indentation doesn't matter in the old cap, but it does in the body since it means the new cap will not mate "wood to wood" at the place of indentation unless the bridge body is further reduced after cap removal.

Photo 1 shows a thick cap which chiseled off easily. The holes in the bridge body have been filled with hardwood shoe pegs — available from American Piano Supply — and are about to be chiseled off. More on this when we get to recapping.

If the glue joint is too strong the cap will not chisel off cleanly but will tend to pull chunks of the bridge body up with pieces of the cap. Should this be the case it will become obvious early on so abandon the technique and go on to another. Minor damage sustained by the bridge body in this trial stage is easily repaired.

If the technique is working, however, remember that the cap only is being removed, and that caps are usually not uniformly thick. That is, it might be thinner in the treble and thicker in the tenor, or vice-versa. That's why it is important to measure the height of the old bridge, cap included, *before* the old cap is removed. In addition, if the old cap is thin (less than 1/4"), then regardless of how easy it chisels off, reread the caution above since a decision is necessary as to how the recapping is going to be accomplished. My thickness planer, for example, cannot plane to less than 1/4" so I would not even bother to chisel off a thin cap except as bulk removal to make ready for other means of bridge top reduction. But again, if downbearing is going to be set by using the plate then a too-thick cap can be glued on and planed back to the thinner final condition.

A word on softening the old glue with acids and miracle solutions: this has not worked well for me. I never have been able to find a reliable way to get the liquid where it is needed — between the cap and bridge body. Some technicians claim success, however.

Hand Planing

Anyone who has worked with hand planes has learned that these tools are not for amateurs. In the hands of a skilled craftsman a plane appears to be — at least to the superficial "Hey, anyone can do that!" personality — as simple to use as a computer; but that's only because the plane-master has sweat years developing the feel for the tool, the subtleties of its ways, whereas the cool Nintendo-master knows nothing of these mysteries. Books have been written about planecraft, and the purchase of a quality plane usually includes a booklet on the use and adjustment of the tool. Read such literature before undertaking the use of hand planes. Most piano technicians have little opportunity for need for serious hand planing, extensive use of such skills being reserved for rebuilders.

Obviously, hand planes have useful applications in removing old bridge tops. The size of plane to use depends on what section of bridge top is being removed; if only the highest treble section, for example, a large or even medium-to-small hand plane is useless as there is not the working space as exists in the low tenor up to the treble, or around certain bass bridges. Photos 2 and 3 show a technique which combines chiseling and planing. The chiseling in photo 2 is *not* the technique as explained above but is being done to remove bulk material only in the highest treble section of a bridge. The final leveling and wood removal is more carefully accomplished with the "rabbet plane" shown in photo 3, and with cabinet scrapers (not shown). See photo 4 for a side view of the rabbet plane working on a bass bridge. This excellent tool is available from specialty woodworking supply catalogs and currently costs about $70 — and well worth it. They are fine-adjustable, hefty, and the top of the body is removable converting the plane into a "chisel plane."

The fore-and-aft orientation of the rabbet plane in photo 3 is actually the working position of the tool. That is, the planing motion is not along the grain — obviously not possible — but across it or skew of it. The short, curly shavings in the photo attest to this fact. If the top two treble sections were being replaced rather than the highest section only, there would have been sufficient working room to use the plane along the grain for at least part of the cap length. If desired, it is possible to plane down below the cap into the bridge body but care must be taken to keep the surface level — less of a problem when planing off the cap only since the bridge body, especially Steinway types as in the photo, acts as a visual reference as to where to stop planing. Photo 5 shows the planing and leveling complete. Having been planed, cabinet-scraped and partially block-sanded it is ready for shoe pegs and final finishing prior to cap installation.

A word of caution on making ready the bridge body for a new cap: the tendency in working with all the tools — chisels, planes, scrapers, sanding blocks, or, to a lesser extent, power tools — is to round off the cross-sectional corners of the bridge such that the new cap would only touch along the center area of its length but not at the edges. To glue on the new cap while the body is in such a condition would mean the appearance of glaring glue seams. This is easily avoidable if care is taken along the way to insure that a flat surface relative to cross-sction is evolving rather than a humped one. Cabinet scraper blades — the flexible steel plates that have no

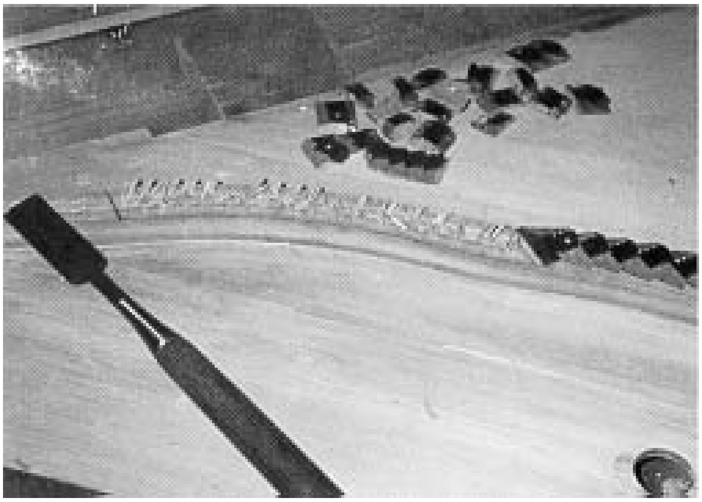

photo 1

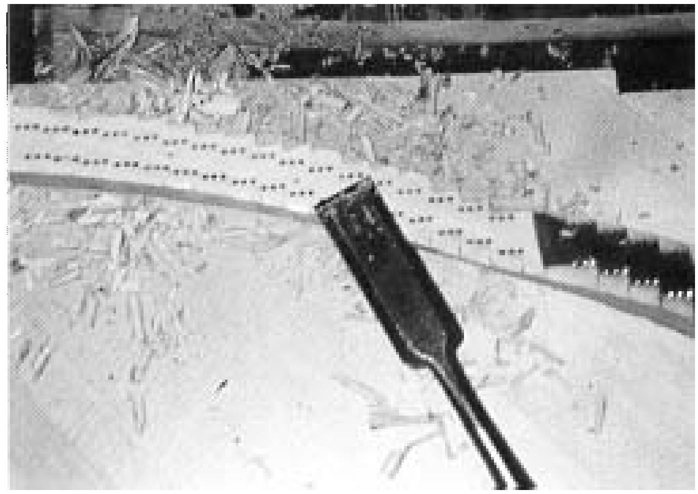

photo 2

photo 3

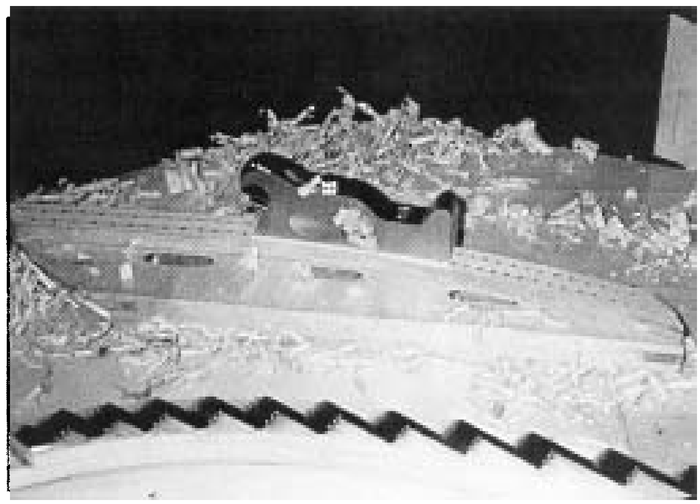

photo 4

handles — are excellent for leveling for two reasons. First, since it is necessary to flex them into a curve in order to use them at all, these cutting tools can cut small portions of material along the length of a cut. In fact, the more they are flexed into a curve, the less material in *width* will be cut off. This being so it is possible to "flatten the hump" of a rounded bridge body by flexing a scraper blade and pushing (or pulling) it lengthwise along the bridge taking care to avoid the edges and corners. Eventually, the rounded top of the bridge body will flatten to meet the edges. Second, since in the unflexed state a scraper blade cutting edge represents a straight line, the tool acts as a try square to test the flatness of the work. So, then, the technique alternates between flexing-scraping and relaxing-trying (i.e., testing for flatness). It actually works; and, oh, be sure to have *two* types of scrapers on hand, a thicker type (the usual type you get when you buy one) and a thin, very flexible type which, although not the insensitive workhorse of the thicker type, is extremely useful and much less tiring on the hands and fingers.

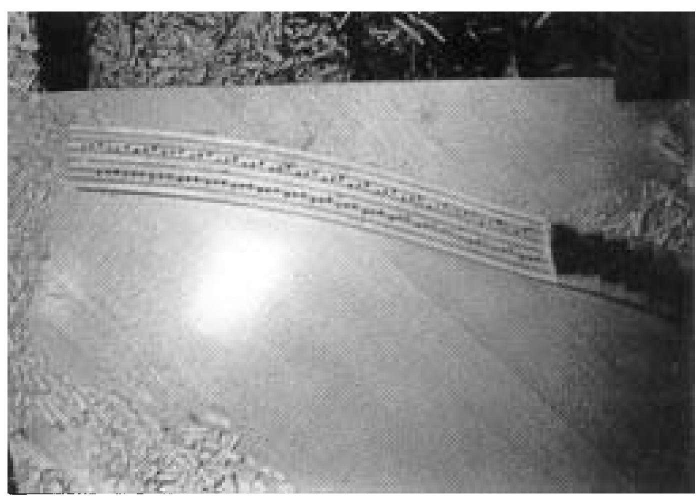

photo 5

Hand planing of bridge tops is particularly more effective if the entire long bridge is going to be recapped since there is much more working room and freedom of tool movement. Still, the case at the tail and the treble end of the long bridge offers obstruction to clean sailing by not allowing the plane to get a bite on the bridge top close to these areas. Large planes (the 15" jack, for example) can usually be used freely through the open center span while smaller planes (the smooth plane, or low angle block plane, or the rabbet plane) must be used nearer the case. The chisel plane feature of the convertible rabbet plane, helps to level the bridge body right to the ends of the bridges, but its not always completely effective working through that hard wood. The process of hand planing is sort of like pitch raising or bulk action regulation of new parts; these processes begin by getting one into the ballpark, as it were, by paying more attention to quantity at first; but as the job continues the quantity aspect gives way to quality and at the very end of the cycle quantity counts for nothing and quality for everything.

So true of bridge top planing. The aim of the initial process simply to remove as much wood as possible (but obviously not below some prescribed level) with the biggest workable plane available. As the work gets nearer to being fine rather than rough, and the bridge body level is becoming closer to being a good glue joint surface, the planes tend to get smaller. But it is necessary to have some target at which to aim. If a cap is being removed, the target will be the glue joint of cap to body. If the plan is to plane below the cap and into the body (or if the original bridge top was not capped) a scribe or pencil line is necessary along the sides of the bridge representing the top of the eventual planed surface; plane to the line and stop. If skilled with a cabinet maker's marking gauge a nice sharp line can be cut into the bridge sides for this purpose. But since the gauge face is working off the notched surface of the old bridge top it doesn't serve its function as truly as it otherwise does; usually well enough, however. If an awl or pencil is used to impart this line a suitable "straightedge" will have to be devised out of some very flexible material and pressed against the bridge sides. It takes two people to carry out this marking procedure.

It is important to recognize that the final surface of the planed bridge body will not necessarily be defined as a "plane surface," that is, a straightedge placed along the bridge length and on top of it might rock a bit indicating that the planed surface is higher in the center area and lower at the ends. This is perfectly all right. What needs to be avoided is a roller coaster surface of closely spaced hills and valleys. Bass bridge surfaces should be flat, plane and true, and are much easier to get that way than the long bridge anyway.

Bridge recapping, like all in-depth piano restoration, demands the qualities of self that Dorothy and her companions discovered somewhere over the rainbow: brains, heart, and, yes, courage. But for heaven's sake, don't let little dogs into your shop.

Next time we will have a look at other methods of bridge top removal such as power planing and routing. ≣

Learning To Pass The PTG Tuning Exam Part IX: Stability

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Before getting into this month's topic, let's review briefly what happens after you've finished your initial tuning and the examiners re-enter the room: measurement, initial scoring and aural verification.

Up until now we have been dealing with sections of the tuning exam that can be aurally verified by means of interval checks. Immediately after you finish your initial tuning, we measure it and crunch the numbers for awhile. Then the CTE in charge writes down the penalty points, directs the aural verification, and finally calculates the scores through the high treble section. During this time you are free to take a break or to stick around and watch; normally it takes about .75 - 1.5 hours. If you stick around, we may invite you to participate in measurement and aural verification, but this is voluntary and usually has no effect on your score. The possible exception is the occasional unverifiable penalty point that has to be thrown out which does change your score slightly, though even the most vigorous defense of your tuning hardly ever changes the overall results (pass/fail). You have to live with what you did. You should be aware that examiners are not required to aurally verify each and every alleged penalty point, much as you might want to contest each one, but rather only as many as seem appropriate within the context of an overall 1/2 hour time frame for aural verification. In cases where there are many errors, we will only verify the larger ones until satisfied that the exam was scored properly. You may find out your scores as aural verification proceeds in the pitch, temperament, midrange, bass, treble and high treble sections.

How To Score Well On Stability

The next section of the exam after the initial scoring and aural verification is the stability test, which can also proceed whether or not you're in the room. To score stability on your single-string tuning, we set up the measuring instrument on the appropriate test partial of note C3, and measure it playing softly to get a "before" value. Then we simulate by hand the standard test blow of 8 ounces dead weight dropped from 6 inches onto the key, three times. We then play softly again and check the measuring instrument to see if the pitch has changed, and if so we measure to find out how much. If the difference between the before and after measurements is less than 1.0 cent, you get away with it. With 1.0 cent or more, we score 1 point off. (Even if it drops 10 cents, it's still only 1 point off!) We perform this test on the 24 midrange notes, C3-B4, add up the points, multiply the sum by 4 and subtract the product from 100 to get the final score. To pass this section at 80% or better, you can have no more than 5 notes fall out of tolerance.

For you to score well in this section, you need to have properly set the individual string/tuning pin systems by some combination of hammer technique and moderately hard test blows while you are tuning. However, it's not a good idea to worry about stability as an afterthought to your midrange tuning. You're wasting time if you destroy a nice temperament, for example, with 13 or more murderous test blows after the fact. You should be stabilizing the notes as you go. The quick pre-tuning I have advocated to avoid penalties for totally untuned notes would also be a good first step for reasons of stability. The closer you are to the desired pitch to start with, the less difficult it is to stabilize the string/tuning pin system. On the other end of the spectrum, tinkering endlessly with your midrange tuning out of nervousness or misplaced perfectionism can reduce your chances of passing stability, since you may have a tendency to not stabilize your settings as well while in the tinkering mode.

Now's a good time to do a re-run of hint #6: Don't use any more forceful test blows during a tuning exam than you would normally use in the field to produce a stable tuning. You can check your own tuning stability by tuning a few midrange octaves on a strip-muted piano as you normally might, and using an instrument such as a Sanderson Accu-Tuner to make sure that each note withstands three moderately hard test blows within the measurement accuracy of the instrument. Alternately, use contiguous interval checks before and after the test blows to detect any movement. There should be no difference in the before and after sounds of like intervals above and below the note being tested.

What Does It Mean?

Having read the above, you should be able to practice ahead of time and score well on stability in the test, as long as you avoid a lot of tinkering at the last minute. The stability test is an indicator of how well you will be able to do a stable tuning in the real world, other factors allowing, even though the temperament strip probably absorbs some of the shock of the test blow. If you can't do it on one string under these conditions, how are you going to do it on three?

The first indication of an unstable tuning to a customer is usually an out-of-tune unison. Even so, there is a logic to scoring stability separately from unisons, if you consider that part of our purpose in having sections at all is to be able to isolate problem areas. If we scored stability and unisons together (as our customers do!) we wouldn't know which area was more of a problem. Did the string "slip," or was it mis-tuned to begin with?

You may wince as the examiner applies the stability test blows to your delicately-crafted midrange tuning, but at least those middle strings will be less likely to cause problems in the unison test to follow, when your examiners will be playing your tuning rather softly without stressing it as for the stability test. (If these kinds of things upset you, then you probably don't want to hang around after your test to see how a detuning is done!) In any case, you need have no cause for concern if you have practiced stability ahead of time and know that you can achieve the required results.

Stability Factors

I can well imagine a "SNTT" (Skilled Non-Tuning Technician) reading these two words and immediately thinking of structural integrity, pinblock fit, tuning pin torque, plate seating, termination conditions (at the bridge notch and bridge-pin, agraffe and capo) and other factors. I guess we'd have to call this nitt-picking. Seriously, stability is one of the most important characteristics of a well-manufactured or remanufactured piano, along with its dynamic range and tone and its uniform responsiveness of touch. Some piano designs appear to be relatively unstable with respect to holding a tuning for any length of time (spinets, for example, as well as some ill- conceived or poorly-built uprights and grands) while others, given comparable and not necessarily museum-quality environmental conditions, do not seem to change much from one tuning to the next.

While true that there are many factors affecting tuning stability other than anything you can do with a tuning hammer, the designers of the tuning exam made an assumption that these factors could be minimized by setting minimum quality and environmental standards for exam pianos and exams. You will therefore not be required to pitch-raise and tune a spinet on a beach with the hot sun beating down on you! We do try to use only high-quality, well-scaled instruments for exams, and check them over fairly well, and conduct exams in quiet, comfortable rooms.

However, you should be familiar with any of the currently available grands in the 5'9" or larger range. The exam room is certainly not the place to tune your first grand, but beyond that, there are variations of tuning pin "feel" — differences in the "marshmallow zone" (see D. Bowman article in the February 1989 *Journal*) of various makes of pianos which are all acceptable for testing, provided no gross defects of design, scaling, manufacture or conditions of negligence are present.

I will not attempt to describe and resolve all the difficulties you might encounter, but rather only bring up a few ideas that may help you as you learn to tune with stability. What is it, exactly, that we're trying to do here?

Some years ago at a DC Chapter meeting, Jim Hayes, RTT (then of the Connecticut Chapter, PTG, now of Western Mass.) put on a technical session — the subjects were strings, string breakage & splicing, inharmonicity, scaling formulas and related topics. If you've ever been to one of his classes, you probably came away with the delightful feeling of having been informed as well as entertained; the man sure knew how to have fun. He had more uses for a pair of vise grips! Anyway, in this class he used a prop which vaguely resembled what we now know as the stringing jig in the technical exam, and among other things showed why some strings go out of tune quickly, and some stay where you put them, according to the relative tensions of the wire in the mute lengths vs. the speaking length.

The Stable Condition

The stable condition to leave a string in so that it will resist the stress of playing with no perceptible pitch drop is actually NOT one in which the tension is equal along all segments of the string from the tuning pin to the hitch pin, as may be commonly believed. Jim Hayes demonstrated that a more stable condition than equal tension is having a slightly greater tension in the mute, tuning pin/hitch pin lengths of wire than in the speaking length. It is precisely this unequal tension (retained by friction at the terminations) that compels the speaking length to remain at the pitch we set it even after heavy playing. Though I have forgotten the details of the demonstration, such was the conclusion, as I recall.

Of note here is the rather widespread use of the term "equalized" when referring to string segment tensions in the stable state, and I would not assume that authors who have used this term take it literally to mean equal tension in all the string segments. It is more likely that the meaning of "equalized" is closer to "stabilized" in current usage, and I would suggest the latter be substituted for clarity as you read any of the articles in the reference list at the end of this one.

I believe that this condition for string tension stability is what we try to establish during our tuning. Of interest also is the possibility of over-doing it. You can "over-set" the string (by using overly forceful, repeated test blows) in effect making the tension difference too great in favor of the mute lengths of wire, so that the speaking length may actually rise in pitch when played as wire is pulled from the speaking length by the mute lengths. I'm sure this would make an interesting demonstration, though I doubt it's a problem for many of us.

Getting There

A good technique includes the necessary skill to make tiny incremental movements of the tuning pin in the pinblock. That is one of the hardest skills for the new tuner to learn, yet is so important for working efficiently. As you exert rotational pressure (torque) on the tuning pin, the top of the pin twists first, followed by the pin in the block. With experience, you can feel and control the tiniest movements. In addition, the pin segment out of the block can bend or "flagpole." Both of these tiny movements can be used to help effect stability. One way to establish stability is to use rather hard test blows, which has the effect of pulling wire into the speaking length, creating the stabilizing tension difference. You have to guess how much drop will occur, overshoot the desired pitch by an appropriate amount (the less the better), and while exerting a slight counterclockwise turning (pitch-lowering) and pushing force on the tuning pin, but without moving it in the block, play the key fairly hard to nail in the desired pitch. If the pitch does not rise back up when you release pressure on the tuning pin, and the pin has not inadvertently turned in the block, you will have created the stable condition. Please don't get carried away with pin-bending; as strong as they are, they do break, and wouldn't that be a fine mess!

Some of what follows would have to be considered conjectural, since I've seen no published data on tuning pin twisting, bending, and wire tensions in various segments. However, I find it useful to think that what happens here at the front end is not so much dependent on the test blow as on the careful manipulation of the tuning pin rotation and bend. In the stable condition, the tuning pin acts as a two-way spring to hold the higher tension on its mute length of wire. The tension difference is held by friction mostly at the front termination of the speaking length. Properly set, the pin is held against further rotation by friction in the pinblock (and possibly the plate bushing if present), with the top of the pin twisted slightly in the counterclockwise direction and also bent slightly in the direction of wire pull. There will be no tendency to twist or bend further. This slight twist provides one part of the spring, since the twisted tuning pin will be trying to untwist against the torque applied by the string tension. The slight bend provides the other as the pin tries to straighten up against the pull. Combined, when you release pressure from the tuning hammer, the effect is to raise the tension in the front mute length without affecting (hopefully) the tension in the speaking length. Given the small pitch changes involved, you shouldn't have to employ extremely hard test blows to accomplish this. Of course, various manufacturers have their own ideas about front duplex bars, counterbearing angles and the like, which can make our job more difficult due to extra friction. (Perhaps you've encountered that Chickering grand with that extra steep slope from the front string rest down to the agraffe! Gawd.)

What happens at the hitch pin end of the string may be more dependent on a hard test blow, if anything. The test blow is useful not only as its name implies, to see if your pitch setting is stable, but also as a tuning technique to pull wire into the speaking length from both ends to help create the stable condition. Unless you physically manipulate the wire at the other end, a very hard test blow may be the only way to change anything at the hitch pin end, though I doubt much will change through the zig-zag of the bridge pins. The thought here is that a hard blow may tend to pull wire into the speaking length, and you then take up the slack by turning the tuning pin and resetting for stability as described.

By physical manipulation I refer to such techniques as pressing a hardwood dowel into the string from the front bridge pin, pushing it down on the string as you move it forward along the speaking length for a short distance. Though this helps to seat the wire at the front bridge pin, another effect is to create that tension difference we want between the rear mute length and the speaking length. I do not recommend this procedure unless you're faced with a pitch adjustment anyway, since it does cause significant pitch drop, and it is *not* appropriate or necessary for the exam or even for most ordinary tuning. However, if you live in an environment that gets as humid as the DC area most summers, you may want to add this to your pitch-lowering routine.

Conclusion

Skill in tuning pianos with stability is among the most basic and important that every RTT should have. You can do everything you need to do to pass stability on the PTG Tuning Exam by a combination of a moderately hard test blow and by properly employing a concept of how to use the tuning pin to your advantage. Skill in making tiny incremental movements of the tuning pin in the pinblock is essential. You pull the string a little sharp, being sure to move the pin in the block, then reverse direction, and without moving the pin in the block, exert pressure in the counterclockwise direction as you strike the key moderately hard. If upon releasing pressure the pitch comes back too sharp, try again from a little less above pitch. If the pitch drops too much, try again from a little more above pitch. When you think you've got it, remove the tuning hammer from the pin and do another test blow to be sure.

Next month: unisons

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Tones Created By The Ear

Jack Greenfield, RTT
Chicago Chapter

The Discovery Of Difference Tones

Included among the important developments in acoustics during the eighteenth century was the work on the scientific study of the *difference* tone. This is a low sound with definite pitch whose frequency is the difference between the frequencies of a higher pair of tones — for example, the sound with pitch A-220 Hz generated when the notes E-660 Hz and A-440 Hz are played together under the proper conditions. Although the phenomenon is not unusual in the performance of music, it received little close attention until the investigations by two musicians and a part-time scientist with an interest in musical acoustics.

The first account describing difference tones was written by George Andreas Sorge (1703-1787), an organist and keyboard music composer. In a book on music theory, tuning, and temperament, and organ playing published in 1745, Sorge observed that when he played some pairs of organ notes together, he heard a third deeper tone. Sorge was not an especially outstanding composer and except for his writing on difference tones before Tartini, his work would attract little interest today.

The next study of difference tones was a paper written by Jean Baptiste Romieu (1723-1766), a Frenchman with a casual interest in music and acoustic theory. Romieu observed the characteristics of difference tones in experiments with wind instruments. He presented his findings in a paper "A New Discovery of Low Harmonic Sounds", delivered to the Montpelier Royal Society of Sciences in 1751. Romieu was also the author of writings on music theory that are of value as a record of historical temperaments.

While some historians consider Sorge the discoverer of difference tones, others accept the claim of Giuseppi Tartini (1692-1770) that he had noticed the phenomenon of the "terzi suono" (third sounds) in 1714, earlier than Sorge or Romieu. The expression "Tartini" tones has been used in reference to difference tones, giving recognition to Tartini for the discovery.

Tartini was one of the rare important figures in the history of acoustics who was not a professional scientist or mathematician. Instead, he was a professional musician, one of the leading performers and composers of violin music of his era. He spent most of his life in Padua. Educated at the University there, with training in law, religion, and for the army, when he chose his career he decided on music. Displaying great musical talent at an early age, he was largely self-taught.

Tartini was successful in his work as a concert performer, orchestra conductor, composer, teacher, and music theorist. His contemporaries considered him the equal of Antonio Vivaldi as a composer of instrumental sonatas and concertos. He was an outstanding teacher, passing on his musical knowledge to students, including some who became eminent virtuosi of the next generation. In spite of his busy schedule in these activities, Tartini also found time to work on his acoustics investigations.

According to Tartini he discovered the "terzi suono" on the violin while he was quite young. In simple harmony such as thirds and sixths played fairly high up on the violin, bowing two strings at the same time generates the lower sounds of difference tones. Tartini observed the harmonic relationship of the tones and he conceived a method of use of the "third tones" as a check for tuning in just intonation. In later years, after he had started a violin school in Padua in 1728, he taught his students this method of tuning.

After decades of acoustics investigation, in 1754 Tartini published a book on music theory which presented his acoustical discoveries and theories and a new system of harmony based on his observations. Tartini's perceptive studies provided otherwise valuable acoustical information, but he had moved backward in theory. He as well as some of his contemporaries among Italian music theorists, was still influenced by the obsolete principles of Zarlino and the even older doctrines of Greek music theory. They still considered string lengths the standard for pitch measurement although elsewhere in Europe, frequency of vibration of sound waves in air was the accepted measure. In a book published later, in 1767, he made minor changes and corrections, but in general he defended his ideas against the criticism he had received, primarily from the more advanced French scholars.

Early Progress In Research On Difference Tones

Soon after the writings of Sorge, Romieu, and Tartini were published, other investigators with a more current background of scientific training and experience undertook the study of the difference tone phenomenon. In 1759, Joseph Louis Lagrange (1736-1813), presented a theory on difference tones that was well recived. Lagrange, of French-Italian ancestry, was then a professor of mathematics in Turin, before he moved on to Paris where he acquired greater fame as a mathematician. In the work at Turin, concerned with the application of mathematics to acoustics, Lagrange derived a new formula for the motion of vibrating strings and a theory for the generation of difference tones. It was his view that the difference tones were caused by beats. He theorized that while a pair of tones which are close in pitch produce perceptible beats, as the interval is widened, beat frequency increases until the beats gradually pass into continuous sound which is perceived as the difference tone. Lagrange's explanation was widely accepted. Similar views were offered later by distinguished scientists such as Ernst Florenz Friedrich Chladni (1756-1827), Thomas Young (1773-1824) and Rudolf Koenig (1832-1901). As a consequence of the beat theory, difference tones were also called "beat" tones.

Helmholtz Theory Of Combination Tones

During the 1860s, Herman L. F. Helmholtz, among his many other great achievements, offered a new theory that advanced the understanding of difference tones. An outstanding physiologist as well as a physicist, he had made a detailed study of the human ear and the physiological and psychological processes in the sensation of hearing. He conducted tests in laboratory experiments with various types of tone generators, resonator chambers and diaphragms to simulate the effects of sound waves on the human ear. He checked his hypotheses by theoretical physical and mathematical analyses. Helmholtz came to the following conclusions concerning the generation of difference tones:

1. When pairs of loud and continuous musical tones are heard, under some conditions additional tones generated by the ear may also be perceived.
2. Due to the physical construction of the ear, the eardrum does not vibrate symmetrically. Its asymmetrical vibration produces a slight distortion of the sound which gives the sensation of additional combination tones not present in the original signal.
3. Frequencies of primary simple difference tones of the first order heard is equal to the difference between the frequencies of the generating tones. In addition, much weaker summation tones with frequencies equal to the sum of the generating tones may be produced.
4. The upper partials of compound tones interact in the same way to give series of higher order combination tones with frequencies equal to mf_2-nf_1 and mf_2+nf_1 where f_1 and f_2 represent generating tone frequencies and m and n represent the series 1, 2, 3, 4, etc.
5. Due to the construction of the ear, a single simple tone of frequency f will generate the additional frequencies of 2f, 3f, 4f, etc, corresponding to upper harmonic partials or *aural harmonics*.

To a large extent the modern conception of the internal generation of new tones in the aural system, sometimes referred to as *subjective* or *resultant* tones, is based on the principles stated by Helmholtz. Where the modern view differs, however, is in the speculation that the distortion of the original sound takes place elsewhere in the ear instead of at the eardrum as indicated by Helmholtz. His ideas on summation tones are also considered doubtful. The masking effects of loud generating tones prevent conclusive determination of presence or absence of weak summation tones. The modern consensus is that none are generated in the ear.

Acoustical Characteristics Of Combination Tones

The generation of additional tones not present in the original sounds is now referred to as *non-linear* distortion. If the ear were perfectly linear, only the frequencies of the original tones would be heard.

Laboratory demonstrations of combination tones are usually conducted with audio generators that produce pure tones. Under laboratory conditions, it is possible for a given pair of generating tones to produce difference tones of several different frequencies. In the laboratory as well as with musical instruments, the most clearly audible is the simple f_2-f_1 difference tone, the historic "Tartini" tone also known as the *quadratic* difference tone for technical purposes. Those tones are most obvious when the two original tones are fairly loud, high in pitch, and no wider than the interval of a sixth. Within a limited frequency range, another tone, with frequency $2f_1$-f_2, known as the *cubic* difference tone, may also be fairly audible. Frequencies corresponding to difference in higher harmonics, for example $3f_1$-$2f_2$, are others detected in laboratory research.

Non-linear distortion giving new frequencies not in the one original musical tones may occur in acoustical generators of musical instruments such as soundboards or diaphragms,or in low quality audio equipment, as well as in the ear. The new frequencies added can include sum and difference tones and upper harmonic partials.

Difference Tones In Musical Performance

In actual musical performance, difference tones are usually most obvious in duets played by flutes or recorders or sung by two sopranos. Although some difference tone frequencies do not coincide with equal temperament frequencies, in general no objectionable dissonance is found. Difference tones may have some effect on the quality of notes played on the piano, but are hard to detect because they fade more rapidly than the generating tones and they are masked by the beating of upper partials.

While some earlier composers may have known how they occurred, use of difference tones in composition was not discussed specifically until the twentieth century. In a book "The Craft of Musical Composition" (1945) Paul Hindemith discussed the enhancement of the musical effect by the generation of difference tones. An outstanding example occurs in the finale of Sibelius' Symphony No. 1. While the rest of the orchestra is silent, two flutes play a passage in thirds in the second octave above middle C. The passage ends when the flutes are interrupted by a forte chord played by horns and bassoons. As shown by Campbell and Greated, the flute tones generate cubic difference tones as well as simple difference tones.

Example Of Difference Tones Generated By Two Simple Tones

Generating Tones	E5 C5	F5 C5	F#5 C5	G5 C5	A5 C5
Simple Difference Tone	C#3	F3	A3	C4	F4
Cubic Difference Tone	G4	F4	E4	C4	E3

Difference Tones In Organs

Difference tones have a practical application in the construction of organs. To reduce building costs, as a substitute for the large pipes which give the lower frequency bottom bass notes, some organs have been built with smaller pipes paired to generate difference tones at the desired pitch. For example, instead of a huge 32-foot open pipe to sound C_0 at approximately 16Hz, open pipes 16 feet and 10 2/3 feet providing 32 Hz and 48HZ can be substituted. Since a closed or stopped pipe has a pitch that is an octave below the pitch of an open pipe of the same length, a pair of pipes 8 feet and 5 1/3 feet long is an even more economical alternative for a single 32 foot open pipe. Organ builders use the terms *acoustic bass, resultant bass* and *harmonic bass* for the sets of pipes giving such low pitch difference tones. ≡

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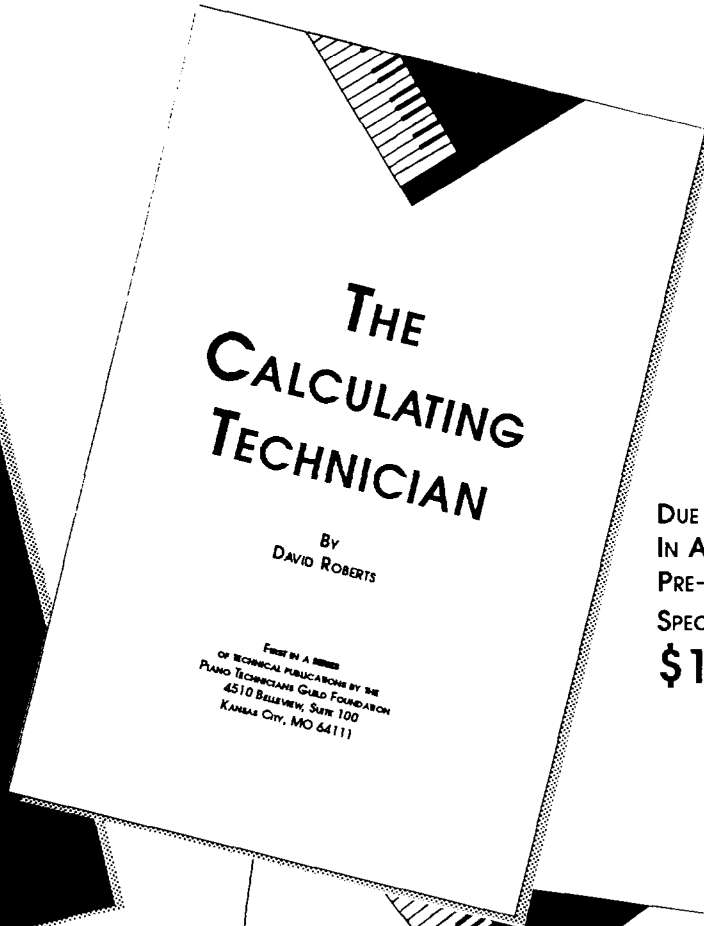

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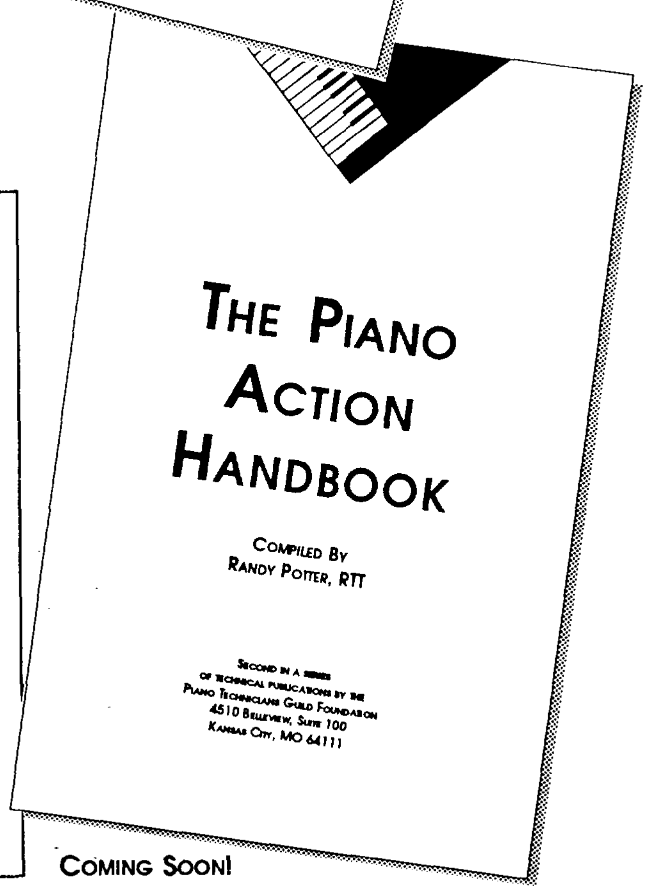

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Coming Events

Sept. 15, 1990	**Rhode Island One Day Seminar** Narragansett Christian Brothers Center Contact: Kirk Russell; 37 Liberty Street; Wakefield, RI 02879 (401) 783-1966
Sept. 28-30, 1990	**Florida State Seminar** Hilton Hotel, Pensacola, FL Contact: Danny Lyons; 1224 E. Cervantes Street; Pensacola, FL 32501 (904) 438-8969
Oct. 4-7, 1990	**Ohio State Conference** Days Hotel, North Randall (Cleveland, OH) Contact: Bob Russell, 1414 Lander Road, Mayfield Heights, OH 44124 (216) 449-5212
Oct. 15, 1990	**Washington D.C. One Day Seminar** Smithsonian Institute Contact: Colette Collier; 12113 Somersworth Drive; Silver Spring, MD 20902 (301) 649-7330
Oct. 17-20, 1990	**New York State Conference** Holiday Inn, Binghamton, NY Contact: Donald R. McKechnie; 1660 Slaterville Road; Ithaca, NY 14850 (607) 277-7112
Oct. 19-21, 1990	**Wisconsin Days** Yahara Center, Madison, WI Contact: Norman Sheppard; 5715 Cedar Place, Madison, WI 53705 (608) 233-3844
Nov. 1-4, 1990	**Texas State Association** El Paso Airport Hilton, El Paso Contact: Guy Nichols; 901 S. Main; Las Cruces, NM 88005 (505) 524-1465
Nov. 9-10, 1990	**North Carolina State Seminar** Brownstone Hotel, Raleigh, NC Contact: Tom Karl; 20 Mayo Street, Apt. F-6; Raleigh, NC 27603 (919) 832-3149
Jan. 4-5, 1991	**Arizona State Seminar** Tempe, AZ Contact: Gary Miles; 3722 W. Port Royale Lane; Phoenix, AZ 85023 (602) 942-2588
July 13-17, 1991	**34th Annual PTG Convention & Technical Institute** Adams Mark Hotel, Philadelphia, PA Contact: Piano Technicians Guild; 4510 Belleview, Suite 100; Kansas City, MO 64111 (816) 753-7747

Auxiliary Exchange

President's Message

Thank you for electing me to the office of president of the Piano Technicians Guild Auxiliary. I shall be relying heavily upon the advice and support of past presidents and past and present board members of the PTGA, and look forward to serving you in any and every way that I am able.

Please, if you, as members of the Auxiliary, have any ideas to better our programs, ideas for new projects or membership boosting — write or call me or any board member of the PTGA during the coming year. We will try to implement your suggestions wherever possible. We need "light bulbs" going on all over the country and the world of the Guild.

Since I have just completed my term as membership chairman, I am still programmed toward drawing in more members, especially spouses of our Guild members. We have so many talented female members of the Piano Technicians Guild today.

Can't someone come up with new methods of bringing their husbands and friends into our Auxiliary? We do have a few intrepid male spouse-members out there. How about a drive to lure more of them in during the fall and winter season?

I'm sure our new vice president and membership chairman, Phyllis Tremper, will be ready to lasso any new Auxiliary members sent her way!

Arlene M. Paetow, President

From The Council Meeting In Dallas

For the 33rd time in as many years the PTGA Council met to consider Auxiliary business. With delegates hailing from eight chapters and seven regions, the meeting was called to order at 10:45 a.m. on July 8, 1990, in the Hyatt Regency Dallas, Agnes Huether presiding. Officer activity reports from the president, vice president, recording secretary, and treasurer combined with committee reports from the audit, bylaws, child care, cookbook, executive handbook, membership, nominating, scholarship, and sunshine committees gave even the newcomer a profile of what had happened in the Auxiliary since our last meeting in Portland in July 1989.

Ailsa Thompson, professional parliamentarian for the Piano Technicians Guild, was on hand to assist with both the Council meeting and our project of beginning a bylaws revision. Since a bylaws revision is in progress the Council was able to pass a revision of the voting procedure which permits an election by voice vote when only one candidate is nominated for an office.

Each year the Auxiliary donates money to the scholarship fund. This donation is a direct sum in addition to the profits from various fundraising projects the Auxiliary sponsors. This year's Council voted to increase that amount to $100.

The nominating committee presented a slate of officers for the coming year. The Council decided to elect each of the slated candidates. The following people were elected to serve you: Arlene Paetow, president; Phyllis Tremper, vice president; Ivagene Dege, recording secretary; Marge Moonan, corresponding secretary; Barbara Fandrich, treasurer.

The nominating committee for the coming year is Nancy Strouss, chairman; with Miriam Snyder and Barb Fandrich as members.

A budget of $3,720 for the 1990-91 year was passed, an amount which includes continuing our bi-annual newsletter and sending our president to the October planning meeting in Philadelphia for next year's convention. The Council decided to spend about $225 on the sunshine committee so they can continue to send cards to members on special occasions, and $125 on the scholarship committee to cover all those calls and letters involved in making arrangements for the contest awards.

The delegates discussed child care provisions for some of the convention events. The Council authorized Eileen Guthrie to continue her work with the child care committee and to proceed with plans for the Philadelphia convention.

The meeting adjourned at 12:15 p.m.

A Renewed Editor

With this issue a new editor assumes responsibility for the Auxiliary Exchange column. Rounds of applause go to Agnes Huether who has edited this column and been president at the same time. Thank you , Agnes, for working month after month collecting and submitting copy for these pages.

The new editor is not a stranger to these pages. In fact, the new editor has previously edited these pages for the Auxiliary. Julie Berry, a past president of the Auxiliary, is committed to PTGA and its programs. She believes communication among the members throughout the year is vital to an organization which sits in formal Council just once a year. Julie, wife of Ron Berry, RTT, works part-time as an editor for a publisher of books on infertility and adoption, and full-time as a mother to Charles, 6, and Daniel, 3.

Let's Hear From You

Please take a moment to jot down or give a call to let us know your answer to the following three questions:
1. How did your spouse or friend get into piano technology?
2. How does your spouse or friend feel about being a piano technician? 3. How do you feel about your spouse or friend being a piano technician?

These questions may seem simple, but your honest responses can provide an interesting exchange for this column. Names will be withheld upon request.

Reply right away to: **Julie Berry, 6520 Parker Lane, Indianapolis, IN 46220-2259, phone: (317) 255-8213.**

Introducing Your New Auxiliary Board Members...

President
Arlene Paetow (William)
Rt. 1, Box 473
High Falls, NY 12440
(914) 687-0364

Vice President
Phyllis Tremper (Fred)
413 Skaggs Road
Morehead, KY 40351
(606) 783-1717

Recording Secretary
Ivagene Dege (Ernest)
2056 Milan Avenue
S. Pasadena, CA 91030
(213) 682-2064

Corresponding Secretary
Marge Moonan (William)
811 Amherst Drive
Rome, NY 13440
(315) 337-4193

Treasurer
Barbara Fandrich (Delwin)
10131 S.E. Talbert
Clackamas, OR 97015
(503) 653-7576

Immediate Past President
Agnes Huether (Charles)
34 Jacklin Court
Clifton, NJ 07012
(201) 473-1341

PTGA? Why Join?

I would like to respond to the June article by Julie Berry. In this changing society of ours the roles that women play seem to be taking on a new dimension. However, there is a need in all of us to be accepted and a part of a group.

In 1982, the California Department of Mental Health began a program called "Friends Can Be Good Medicine." Keith E. Davis, a professor of psychology, and his colleague, Michael J. Todd, developed a list of what they believed are central characteristics of friendship and what I believe PTGA can mean to you, if you let it!

•*Enjoyment*. In spite of mutual annoyances and disappointments, friends enjoy each other's company.

•*Acceptance*. Friends accept one another without trying to change each other.

•*Respect*. Friends show consideration for each other's rights and feelings.

•*Trust*. "Trust in a friendship implies: You won't hurt me."

•*Mutual Assistance*. Friends are always ready to offer aid during times of need.

•*Confiding*. Friends share their most private experiences and deepest feelings.

•*Understanding*. Friends sense what is important to each other.

•*Openness*. Each friend is free to "think aloud" with no need to hide behind superficiality.

As the spouse of a piano technician there is already a common bond for us that allows us to be open about our feelings and our needs. It's amazing how much better you feel when you know you are not alone.

Judy White

WANT TO JOIN PTGA?

PTGA is an active support group for the Piano Technicians Guild. For information about joining, please call or write our Membership Chairman

Phyllis Tremper, Vice President
413 Skaggs Road
Morehead, KY 40351
(606) 783-1717

For The Scholarship Fund

The following contributions to the PTGA have been received in recent months:

In memory of Esther Erickson by Albert Anderson

In memory of Arvid Vennberg by Albert Anderson

In memory of C.R. "Shorty" Wagner by Grace Wagner

In memory of Robert Russell, Sr. by Barbara Yepson

In memory of Helga Palsson Tighe by Stearne S. Tighe

In honor of Audrey Eaton by Nancy Lamoreaux

In addition, contributions to the scholarship fund were received from Anita Charles, Irene Johns, and Julia Wibiral.

If you would like to make a contribution to the PTGA Scholarship Fund you may send a check (payable to PTGA Scholarship Fund) to the Piano Technicians Guild Foundation, 4510 Belleview, Suite 100, Kansas City, MO 64111. Contributions of any size are welcomed at any time.

... And Your New Auxiliary Exchange Editor

Julie Berry (Ron)
6520 Parker Lane
Indianapolis, IN
46220-2259
(317) 255-8213

Need a gift for that fall bridal shower?

Give a PTGA Cookbook and add clever kitchen magnets or potholders! Write or call:

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

Send check or money order (U.S. funds, please) made payable to Piano Technicians Journal, *4510 Belleview, Suite 100, Kansas City, MO 64111.*

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THE GUIDE $10. The Piano Technicians Guide. A job-time study and work guide. Revised and printed to fit a pocket. **Newton J. Hunt, Piano Tuner-Technician; 74 Tunison Road; New Brunswick, NJ 08901. (201) 932-6686**

"LET'S TUNE UP" $20.00 per copy. Last few hardbacks will soon be gone. No immediate plans for another printing. Paperbacks still available at $17.50. Make checks payable to **John W. Travis; 8012 Carroll Avenue; Takoma Park, MD 20912.**

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Wanted

WANTED: STEINWAY AND MASON HAMLIN GRANDS. All sizes and cabinet styles. **Ask for Karen Bean at (415) 676-3355. Piano Finders; P.O. Box 23814; Pleasant Hill, CA 94523.**

WANT TO BUY. Steinway duo-art player grand. Will pay finders fee. Especially want carved (fancy) case. Call Collect, **Jim Brady; (317) 259-4307; 2725 E. 56th Street; Indianapolis, IN 46220.**

UP TO $1000.00 FINDER'S FEE will be paid for successful purchase of a Mason and Hamlin Ex-Player. I have mechanism to install. **Please call collect (317) 259-4307 or evenings (317) 849-1469. Jim Brady; 4609 Cranbrook Drive; Indianapolis, IN 46250.**

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INDEX OF DISPLAY ADVERTISING

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AUGUST **UPDATE** 1990

Published Monthly For Members Of The Piano Technicians Guild, Inc.

Dates & Deadlines

August 18, 1990
RTT Tuning Examinations.
Illinois Test Center. Millikin University; Decatur, IL. Contact: John Baird (217) 429-5651.

RTT Tuning and Technical Examinations. Sacramento, CA. Application deadline: July 18. Contact: Neil Panton, 5 Cedar Court, Menlow Park, CA 95025 (415) 854-8038.

November 16, 1990
Deadline for committee reports for January Board meeting.

January 1, 1991
1991 dues due.

January 31, 1991
1991 dues delinquent.

February 1, 1991
Deadline for nominations for 1991-92 officers due to Nominating Committee Chair.
Deadline for amendments proposed for 1991 Council to be submitted to Bylaws Committee Chair.

March 1, 1991
Deadline for committee reports for inclusion in 1991 Council agenda book.

March 4, 1991
Members delinquent on 1991 dues to be dropped from roster.

July 13-17, 1991
34th International PTG Convention & Institute
Philadelphia, PA
Contact: Home Office; 4510 Belleview, Suite 100; Kansas City, MO 64111; (816) 753-7747.

SC Seminar Held In Mexico City; Mexican Technicians Organize

The second national meeting of piano tuner/technicians of Mexico concluded in Mexico City on May 27 with an important event of historical significance. During a roundtable discussion led by Francisco Chávez, organizer of the meeting, the first association for piano tuner/technicians in Mexico was organized. A committee of eight people was elected to guide the organizational process during the coming year, and to make preparations for the third national meeting to be held in 1991.

The formation of the new association comes as a result of two successful seminars, sponsored in part, by the South Central Region. Instructors for this year's seminar were Ramón Ramírez, tuning; Danny Boone, grand regulating; Dale Lassiter (Kimball), vertical regulation; Gary Neie, Hospital for Hopeless Pianos; and Francisco Revéles (Mexico), key rebushing.

Ramón Ramírez and Linda Scott were named as liaison between the new organization and PTG. Ramón has recently received a Fullbright Scholarship to teach piano technology for five months in Mexico City, and is taking a leave of absence from his assistant piano technician position at the University of Texas at Austin, beginning in September. Linda is a full-time tuner/technician in Mexico City, and both are members of the Austin Chapter. They have also served as interpreters for the seminars in Mexico City.

Plans are being made for the Tercero Encuentro Nacional de Tecnicos en Afinacion y Reparación de Pianos. There is also a possibility of someday having the South Central Regional Spring Seminar in Mexico City in conjunction with the Mexican association.

The organizing committee for the new Mexican association for piano tuner/technicians

In Respectful Memory...

Art Flashman

Arthur "Art" Flashman passed away on October 23, 1990 in Cocoa, FL. He was born on July 1, 1923, in Grand Rapids, MI.

He retired from the Air Force after 23 years which included serving in the Korean War. He was a resident of Cocoa and operated a small well-equipped shop on his property.

Art was a charter member of the Central Florida Chapter, and the chapter president for the past two years.

He was well-known to many in the chapter as a fine technician with a knack for innovative tools and ideas. As an active member of the Central Florida Chapter, he served on technical examinations, conducted many chapter technical meetings at his shop, and was always willing to help the newcomer.

Art is survived by six children and many grandchildren. Those of us that knew Art will surely miss his friendship, guidance and enthusiasm that was valued so much.

Brian Scott

Chapter Notes...

Erie, PA, Chapter

The Erie, PA, Chapter's first annual Young Pianist Competition was held on Tuesday, June 12, at Bollings World of Music in Erie. Twenty-two young pianists entered the competition, and were grouped into three categories: 0-1 year of lessons, 1-2 years, and 2-3 years. First and second prizes were awarded in each level, and all who competed received a plaque engraved to read "PTG Young Pianist Competition 1990."

This event was conceived and put into action by Erie Chapter Vice-President Tony Manna. Bolling's World of Music graciously allowed us to use their space and a new grand piano for the evening. They also provided refreshments for the children and their parents. Prior to the start of the competition, Treasurer Norm Plumb addressed those present and gave a short talk on what PTG is and what it means. The three judges for the contest were Gary Nelms, Loren Di Giorgi, and Bob Sadowski.

Loren Di Giorgi, Erie Chapter President

Santa Clara Valley, CA Chapter

Santa Clara Valley, CA, chapter member Bjarne Dahl has been building more than harpsichords lately. He has also been building good will by sending a repair kit to be used by the technicians and musicians of the town Odessa, in the Ukraine.

This came about because one of our local youth orchestras, the Palo Alto Chamber Orchestra will be traveling to that city to perform as part of its Soviet tour in June. A harpsichord in the city was located, however it has slowly fallen into disrepair as no parts were available. Bjarne was familiar with the make of the instrument, and with some clarification on their most important needs, put together a kit including material for plectra, music wire and other small repair items. Thanks, Bjarne, for being involved in such important sharing and communications between the U.S. and technicians and musicians in the Soviet Union.

This is a reprint from the A-440 Notes, *the Santa Clara Valley PTG newsletter.*

Membership Status

Northeast Region	836
Northeast RTTs	538
Southeast Region	590
Southeast RTTs	390
South Central Reg.	320
South Central RTTs	210
Central East Region	632
Central East RTTs	399
Central West Region	367
Central West RTTs	254
Western Region	609
Western RTTs	404
Pacific NW Region	341
Pacific NW RTTs	233
Total Membership	3695
Total RTTs	2428

Bylaws, Committee Supplement Planned

A *Journal* supplement containing revised versions of the Guild Bylaws, Regulations and Codes, as well as lists of 1990-91 committees, their charges, and other organizational information, will be published in conjunction with the October issue of the magazine. The supplement, which will incorporate actions taken by the 1990 Council, is designed to fill the gap between the July meeting and publication of the next membership directory in April 1991.

College And University Committee Releases Guidelines

"Guidelines for Effective Institutional Piano Maintenance," a 12-page document designed to help conservatories, music schools and other institutions of higher education evaluate and balance budgets, needs, and expectations in maintaining their piano inventories, was introduced by the Guild's College and University Technicians Committee during the recent Dallas convention.

The Guidelines, which are the product of three years of research, study and collaborative effort, were introduced during the committee's forum during this year's annual Technical Institute.

The Guidelines grew out of an open forum involving 50 college and university technicians at the Guild's July 1987 convention in Toronto. Their principal developer, Lou Tasciotti submitted successive drafts of the Guidelines to more than 120 colleagues before the document was finally approved by the organization's board of directors in January 1990.

"The committee has been working on the Guidelines for nearly three years," said Tasciotti, staff technician at the University of North Texas in Denton. "This is longer than we had anticipated, but it has resulted in a much better document."

There are some 1,400 schools of music or music departments in institutions of higher education in North America. Virtually all of them have piano inventories ranging from a few to as many as 500 instruments. For typical performance-oriented conservatories and music schools, the Guidelines recommend a ratio of one full-time technician for every 40 to 60 pianos. For typical non-performance institutions, a ratio of one full-time technician for every 60 to 80 pianos is recommended. Factors affecting institutional piano maintenance programs often include:

- Inadequate maintenance budgets which frequently allow instruments to deteriorate prematurely.
- Artistic demands requiring a high level of performance — pianos in disrepair interfere with instruction, performance and the learning process.
- Heavy use, typically eight to 12 hours daily, the primary cause of deterioration.
- Shared pianos, which leads to neglect and abuse.
- Pianos often kept in unsuitable environments where extreme changes in temperature and humidity contribute to their deterioration.

"Pianos that have been allowed to deteriorate do not properly represent the educational goals of a music institution or music department, the workmanship of skilled piano technicians, or the high-quality manufacturing of the piano maker," the Guidelines conclude.

Copies are available for $5 from the Home Office.

Cumulative Index Published

A five-year cumulative index covering articles appearing in the *Piano Technicians Journal* between 1984 and 1989 is now available from the Home Office.

The new index, which was compiled by Danny L. Boone, RTT, builds on a classified index covering articles published prior to 1979, and a supplement covering those published from 1979 through 1983. Both earlier documents were produced by the late Merle Mason.

"This cumulative index is a continuation of the original indexes, although the format has been changed somewhat," Boone said, noting that the complex numbering system of the earlier indexes has been omitted and the categories and topics have been alphabetized for easy reference.

The new volume contains 23 pages of listings and is bound much like monthly *Journal* issues. The earlier indexes used a plastic binding system.

Current plans are to publish an annual index in each December's *Journal*, and to update the cumulative index each five years — a new index covering 1984 through 1994 will be produced in 1995.

The new five-year index is available from the Home Office for $5. Copies of the earlier volumes are still available. The pre-1979 index is $60 ($50 for Guild members), and the 1979-83 supplement is $15 ($12.50 for Guild members). Prices do not include shipping and handling charges.

Board Elected

Members of the 1990-91 PTG Board of Directors elected during the recent Dallas Convention are: Nolan P. Zeringue, President; Bruce Dornfeld, Vice President; Sharla Kistler, Secretary- Treasurer; James Birch, Northeast RVP; Don Valley, Southeast RVP; Danny Boone, South Central RVP; Richard Bittner, Central East RVP; Michael Drost, Central West RVP; Fern Henry, Western RVP; and Stephen Brady, Pacific Northwest RVP. Full coverage of the Dallas Convention will appear in the September *Journal* and *Update*.

Piano Technicians Guild
Business Aids & Merchandise

Business Aids	***Quantity***	***Total***
Billing Pads* — 2-part with logo, 50 per pad: 1/$4.00, 3/$10.00	______	______
Piano Service Appointment Forms — Green, 6-part: 100/$22.50	______	______
Service Stickers* — red and blue with logo: 100/$6.00, 200/$900, 500/$20.00	______	______
Personalized with your name & address: 500/$50.00, 1,000/$90.00	______	______
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Care of Your Piano	______	______
Piano Pointers	______	______
How Often Should My Piano Be Tuned?	______	______
The Tuner To Turn To	______	______
The Unseen Artist	______	______
Should I Have My Piano Tuned In Summer?	______	______
Reminder Cards	______	______
Publications		
"Piano Parts and Their Functions" by Merle Mason (hardcover, revised edition)		
Member price: $10.50	______	______
Non-member price: $15.50	______	______
"Cumulative Index Supplement" compiled by Danny Boone (covers 1984-1989): $5.00	______	______
"Classified Index Supplement" compiled by Merle Mason (covers 1979-1983)		
Member price: $12.50	______	______
Non-member price: $15.00	______	______
"Classified Index" compiled by Merle Mason (prior to 1979)		
Member price: $50.00	______	______
Non-member price: $60.00	______	______
Journal Binders: Brown, holds one year's issues 1/$6.50, 2/$12	______	______
"The Unseen Artist" video — VHS: $29.95	______	______
Merchandise		
Membership Pins* — lapel-type, gold, with blue and white RTT logo: $5.00	______	______
Tie Bar* — as above, with gold clip: $5.50	______	______
PTG Tie — gray with white and red trim: $25.00	______	______
Coffee Mug — "The Piano Technicians Guild, Inc." in blue on white ceramic 1/$4.00, 4/$13.00, 6/$18.00	______	______
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