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July 1989

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ABOUT THE COVER
More on touchweight in grand pianos. See the Tech Forum, page 10

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President's Message

The Piano Technicians Guild Foundation

Ronald L. Berry, RTT
President

As we come into July when the annual convention happens, it reminds us how important our friends and associates in PTG are to us. We also reflect on those who have passed away duringthe year and are no longer with us to share the joy. We have the Piano Technicians Guild Foundation to honor and remember those who are gone as well as those who are living and have had a great effect on us.

The Piano Technicians Guild Foundation is a totally separate entity from PTG and exists to promote music and the piano in ways that PTG does not do. The Piano Technicians Guild Foundation currently offers a scholarship to the Music Teachers National Association (MTNA) which enables a currently certified teacher to take further training to develop better teaching skills. The Foundation board will meet at the convention and is considering giving to a piano competition for students also. At this point, the PTG Auxiliary, which gives scholarships in the state where we have our convention each year with the winners performing at our convention, also lodges its scholarship fund with the Foundation.

The Foundation is also involved in publishing technical information. It is in the process of publishing Dave Roberts' articles, "The Calculating Technician," in book format. Also in the works is a book of Jack Greenfield's historical articles. Information on these publications will be forthcoming when they are available. There are several others ideas for publishing reprints from old *Journals* on specific subjects which could be of great value to technicians.

The provision is there also for the Foundation to give research grants to someone involved in research which would benefit technicians in general but may not have commercial value. Proposals would need to be submitted to the Foundation Board and would be reviewed by that body.

Where does the Foundation get the money to do these programs? From you. Your contributions, whether to honor someone or to help out the scholarship efforts, are the primary source of income for the Foundation. Because of the Foundation's tax status, these contributions are deductible if you itemize deductions on Schedule A. Over the years, many individuals and chapters have donated to the Piano Technicians Guild Foundation and one member who works as a travel agent even offered to give a donation every time a member makes travel arrangements through her agency.

Donating is simple; just send a check to the Home Office and a note stating that it is a donation to the Foundation and who you wish to honor. Or simpler still, look elsewhere in this Journal for a form to make your donation. Your support helps the Foundation continue its special work in promoting music and piano technology.

From The Home Office

The Journal

We've been talking in the last few months about Home Office functions. A lot of this discussion has centered on convention-related activities, but that's because we in the Home Office have been spending a lot of time lately on that particular topic. If the Portland Convention hasn't passed into the pages of Guild history by the time you read this, however, then it will be close enough to start planning for next year in Dallas — all over but the shouting, as they say.

> *'Our circulation is right at 4,000, not a terribly large number of people with whom to correspond on a regular basis.'*
>
> **Larry Goldsmith**
> **Executive Director**

Next to the convention (and possibly ahead of it) in our Home Office priorities is producing the monthly *Journal*. First, you have to understand the logistics of the operation. Our technical editor, Susan Graham, and our tuning editor, Rick Baldassin, begin months before publication by soliciting articles from new contributors and regular ones. They edit the articles for technical accuracy, obtain additional information if necessary, and write their own columns, which are more or less the heart of each month's magazine.

We also obtain material from several other sources: the Economic Affairs Committee, various officers, and the Auxiliary Exchange editor, to cite a few examples. All told, the *Journal* is composed of material obtained from more than a dozen different sources, not counting the monthly Update.

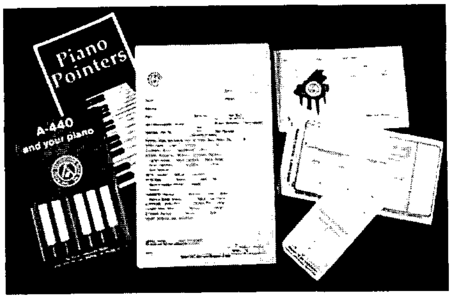
I don't know if you've ever written for a publication on a regular basis, but even if you've done a column for your high-school newspaper, you know how hard it is to keep coming up with fresh ideas — chapter newsletter editors understand what I mean. I'm sometimes amazed that our regular contributors can keep turning out such good material month after month. And presumably while earning a living for themselves as well.

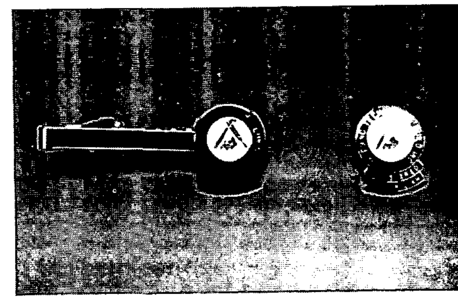
While the editorial material is being collected, we in the Home Office are selling advertising and planning the issue. When we receive the articles, we scan them into our computer system, or if the computer can't decipher it, we retype it. It's then formatted and laid out in the computer so that we can give our printer finished pages to work from. Producing the magazine involves everyone in our office at one time or another.

All told, the process of producing a given issue easily takes two or three months to complete. We're frequently working on different stages of two issues at one time. Printing and mailing alone take at least 10 days, and second-class delivery requires at least a week in good times of the year, more during the holidays.

So much for nuts and bolts. Now, what about content? As I said, coming up with new material is an ongoing problem. Not having a huge budget to hire writers, we're forced to rely on our readers, who are the experts anyway, for articles, questions, comments and information. Our circulation is right at 4,000, which is not a terribly large number of people with whom to correspond on a regular basis, when you think about it.

Some readers tell me they like the magazine, that it contains good articles. Others say they never bother with it. I suppose that's typical of any magazine, but it bothers me. I'd like to provide something of value for everyone. Do me a favor: if there's a topic we should be covering, drop a note to me or to our editors. If you have knowledge that hasn't been published, that's even better — offer to write an article.



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 .... ________ ________

Pamphlets* — 100/$12.50, 500/$55.00 (must be ordered in lots of 100)

- A-440 and Your Piano .... ________ ________
- 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 .... ________ ________

"Classified Index Supplement" compiled by Merle Mason (covers 1979-1983)

- Member price: $12.50 .... ________ ________
- Non-member price: $15.00 .... ________ ________

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 .... ________ ________

Coffee Mug — "The Piano Technicians Guild, Inc." in blue on white ceramic
1/$4.00, 4/$13.00, 6/$18.00 .... ________ ________

Pedestal Mug — 10 oz. clear glass, with "The Piano Technicians Guild, Inc."
in blue: 1/$5.00, 4/$16.00, 6/$22.00 .... ________ ________

"Skill, Integrity, Service" Poster — 16"x 20", color: $1/$9.95 .... ________ ________

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Note: Items marked with a star* are sold only to Registered Tuner-Technicians

Shipping & Handling Charges					
If order totals	Below $5.00	$5 to $9.99	$10 to $14.99	$15 to $24.99	$25 or more
Add:	$2.00	$2.50	$3.00	$3.50	$4.00

Economic Affairs

Self-Esteem And The Piano Tuner

David J. Barr
Economic Affairs
Committee

What is self-esteem and how does it relate to the piano tuner? Self-esteem is a combination of things like self-confidence, a sense of worthiness, and a feeling of imparting value into other people's lives. It is knowing your own sense of worth without the need for constant external reinforcement. It is the ability to see meaning in what you do. It is having principals and living by them. It is a sense of comfort with your own imperfections. It implies a derived sense of pleasure in life and your own accomplishments in that life. It also implies self-caring about others. It is, in a nutshell, knowing your own value. How, then, do all these positive ideas relate to piano tuners?

It is my perception that the last several decades have seen a slow but constant erosion of the self-esteem of most piano tuners. To support this observation, let me list just a few facts and some comments I have heard repeated in many areas by more than a few tuners. First of all, thanks to Janet Leary's recent article, and some calculations by one of our sharper chapter members, it was pointed out that the average tuner has experienced a steady decline in his or her standard of living since 1967 when the Consumer Price Index was started. This may serve as a practical example. In 1967, my parents bought a new 1967 Plymouth Fury II station wagon for just under $4,000. It wasn't a top of the line car, but it was well equipped for the time. A similarly equipped station wagon today would cost about $12,000. Most tuners in this area say that their average price per tuning has about doubled since 1967. Now, while the average cost of goods has virtually tripled in the past 22 years, the average cost of a tuning has only doubled. That translates to an approximate drop in standard of living, or expendable income, of 33%. Somewhere around 1967 or '68, minimum wage was first created. I remember what it was because I had a part time summer job at $1 per hour. The minimum wage has more than tripled since then. Again, our average tuning rate has only doubled.

I have taught a particular business class in several different locations around the Northeast Region and a condensed version at last year's international convention. On a chalkboard, I like to draw two columns. On the one side, I like to try to get a sense of cost of living in the area. We look at housing costs, groceries, transportation, insurance, utilities, etc. On the other side, we look at our potential incomes. It is a sobering exercise. Then we talk about the different means we have at our disposal to make the two columns balance (and we aren't talking about clever ways to make less money). Increasing volume, greater efficiency, and lowering overhead are several possibilities. Raising one's rate is another possibility. Of course, this is a touchy subject. We have to start out by carefully going over what we can and cannot discuss according to the Sherman Anti-Trust Law. We are permitted to discuss general information as a basis for independent individual thought. We cannot encourage any group action along these lines. So, we carefully proceed. Then, we find out just how touchy a subject this really is. There seems to be a greater uneasiness over the competition and a perceived pricing ceiling than there is over any anti-trust law. Many tuners bear as they dare. I relate this to self-esteem because this type of pricing structure seldom allows for that other column on the blackboard we mentioned a few moments ago. What does it really cost today to live decently? If the two columns don't balance with reasonable room to spare, is our confidence in our own or our profession's worth? Income and outlay need to balance in order for anyone to feel confident that their efforts have a proper level of value.

I think that the sad truth is that the average piano tuner no longer sees himself or herself as a valuable, contributing member of society. After all, pianos aren't the center of the home like they once were. The cultured home that once had a piano now has an entertainment center and a computer. The pace of life has changed. Not that many people want to spend the time it takes to learn something as tedious as the piano anymore. Probably only one out of ten of our customers can really tell when the piano is out of tune, anyway. Many customers feel that its time to get the old piano tuned when several keys are sticking or are broken right in the middle of the piano. And, don't you just abhor the person who calls up inquiring about tuning fees just to leave you feeling like you are personally trying to take food out of their very mouth because the last time they had ole Bessie tuned it only cost $20? These callers are masters at manipulating our already damaged self-images.

These are all factors that we must face every day. As these attitudes have become stronger in society, our self-esteems as piano tuners have been taking a beating. I am not going to sit here and tell you that there is some easy miracle answer. The first step in the right direction, though, is accepting that there really is a problem. Then, once it is properly labeled and defined, it will be within our grasps to solve.

Continued on next page

Self-Esteem....

Pianos are no longer held up as symbols of culture, breeding, and education. Culture, breeding, and education are not even held in high regard any longer among many circles in society. Piano tuners are part of this fallout. There seems to be an endless interwoven barrage of negativity surrounding us. Most tuners, in the face of all this, are getting by or at least surviving. Only a few are still making headway. I admit to feeling financially pinched most of the time. Some are almost to the point of admitting to themselves that either they are losers or this profession is lost. I find this tragic, although I constantly fight with similar questions and doubts. I really enjoy what I do and am thoroughly convinced that I have given something of high value to each of my customers in exchange for their hard earned money. I do know, though, that I need to generate a higher income level in order to simply maintain a decent standard of living for myself and my family.

I am convinced that part of the answer is to start with the person in the mirror. Attitudes begin at home. It seems obvious to me that there is something that we as tuners actually fear, otherwise our incomes would simply have naturally kept pace with normal inflation. Part of this fear seems to be a fear that we are no longer needed. Having one's piano tuned, I would venture to say, has never been looked upon as a primary necessity in life. Food, shelter, and clothing are the only things that fall squarely into those categories. There is, though, a need to have pianos tuned. There even seems to be a human need to hear music and, perhaps, to create it. I think we need to rethink our own outlook on our own worth as piano tuners.

I believe more than ever that there is a gaping need in society today for the type of skills and values that piano training imparts to the player. Our whole industry circles around the bottom line notion that the person who plays a piano gains some benefit by doing so. If this were not so, if people did not believe they were benefiting by owning and playing pianos, why did so many of them buy them? Perhaps we need to become more creative in the way we present this notion. Perhaps we need to help develop better ways to impart the necessary skills needed in order to gain the real benefits of piano playing.

I keep working toward a new and improved self-image for piano tuners. I believe that this is necessary in order to make this the strong and vibrant profession that it once was.

Key Leading

Susan Graham
Technical Editor

We have discussed the theory of action touchweight and the practical guidelines for measuring it and determining the location of new or additional leads. We proceed to the actual work on keys.

Now that all keys are marked for releading they are removed from the keyframe for drilling and insertion of leads. Forstner bits, which yield a consistently round, flat bottomed hole, are usually best; bradpoint or even speedbore bits are an acceptable alternative. Bits can be sampled in a piece of wood scrap to determine the size needed for each lead.

Keyleads are slightly conical: drill so the large end fits the hole snugly but will still drop into place. Whether to drill completely through the key is partly determined by preference and partly by the existing style (which should be matched when possible). It is also determined by the thickness of the key...If thickness permits, I don't drill all the way through. This eliminates the tendency of the keys (which can be quite old and brittle) to splinter as the bit exits (even using a backup block this can be a problem). It also makes swedging or expanding the lead somewhat easier, since the lead is prevented from falling completely through the hole: the back of the key may break out during the swedging process, however. If drilling is done with speedbore bits it is almost unavoidable for the hole to go all the way through the key, since the guide point will open up a fairly large exit hole by the time the key is drilled deep enough to accomodate the lead.

Use of a backup block helps to keep the exit hole from splintering. Due to the flare or dogleg of keys in both extremes of the keyboard, it is also necessary to elevate the key to keep the portion being drilled level and perpendicular to the drillbit (fig. 1).

Drilling could be done by hand but is more controllable and consistent on a drillpress. Work efficiently: install the bit for large leads, drill all the large lead holes thoughout the keyboard, then change bits and drill for medium leads, etc., rather than working key by key and repeatedly changing bits.

Figure 1

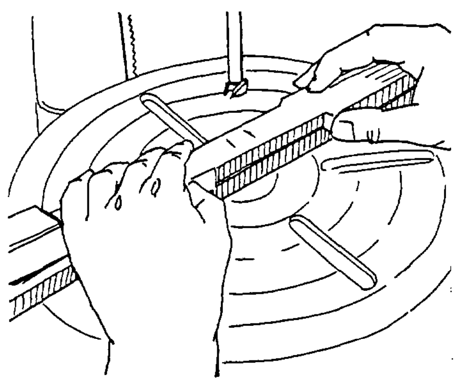


Figure 2

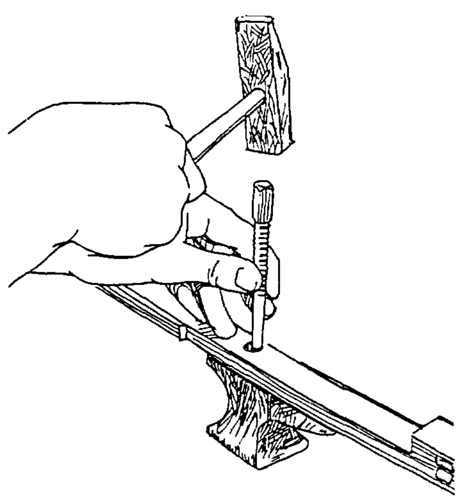
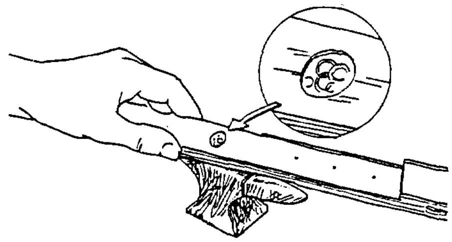


Figure 3



Illustrations by Valerie Winemiller

As the leads are installed they are expanded to fit tightly; they are not customarily glued. Expanding or swedging is done by supporting the key on a firm surface and using a punch or similar metal object to indent the lead, causing it to expand (fig. 2). It should be tight in the hole but should not break the key....swedging with several lighter blows rather than one heavy one can allow you to control the direction in which the lead expands, which is sometimes useful on old keys (fig. 3). I use a standard 1/4" nailset with a slightly concave end as a lead punch.

Preference varies as to whether the leads are inserted into the hole large end or small end first. Small end first leaves the large end exposed; since this end fits the hole more snugly less swedging is required, the lead is more inclined to stay in place during the swedging process, and the potential for damage to the key is be minimized. On the other hand, if the large end goes in first and the small end is swedged to fit, the entire lead is in contact with the edges of the hole—a more solid installation.

Keyleads are inconsistent in shape; some will be tall and noticeably conical, while others are more squat and parallel-sided. If the tall ones require too many blows to swedge properly, simply "pre-expand" them with a blow from the flat face of a hammer *before* dropping them into the key.

Lead is toxic; it is advisable to wear gloves to do this work. At least, scrub thoroughly before eating or smoking.

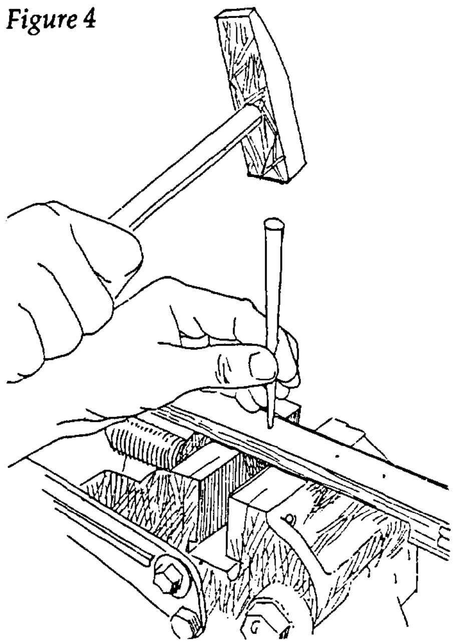
Getting the lead out: We generally think of releading to decrease downweight, but problems also arise in actions with too much lead in the key, creating a light downweight with a slow upweight. A pianist may lack control of the downstroke, since the key offers little resistance. The action will also tend to be sluggish: weight of the action parts doesn't adequately counterbalance the heavy key and the repetition spring is not meeting enough resistance for its force to concentrate on returning the wippen and key. Once again, loose pinning or other friction problems can cause the same symptoms—but for this discussion we assume those things have been checked and corrected.

There's probably some clever way to calculate how much or which lead should be removed from a key which needs "unleading." Being a simple nuts and bolts technician, however, I just remove a lead and see what happens. Usually I start by taking out the lead farthest from the balance rail: this will have the greatest effect. It will almost always solve the too-weak upweight problem. It may be too effective and require relocating and installing smaller leads to correct the downweight. Nevertheless, it seems most efficient to do this rather than to remove the less effective leads nearer the balance rail, gradually changing the touchweight but having to continually reinstall the stack and reweigh the action to check results. In other words, I remove enough lead to go past where I want to be, and then add smaller leads to bring the action back in line with the desired specifications.

Another situation which may require removing leads is found when key leads oxidize and expand, splitting the key. In this instance, remove the lead, repair the key and reinstall a new lead of the same size (unless the action also needs reweighing).

Various techniques may be needed to remove leads without damaging the key. If the hole is one-sided, there is usually enough of a small exit hole to insert a punch and knock out the lead, supporting the key on both sides of the hole (fig. 4). Holes which run all the way through the key offer easy access to the lead: attempt to determine if the lead is still conical, and knock it out toward the big end. Driving out leads may damage the key, especially if the lead was glued in place, was overswedged, or has expanded due to oxidation. It is helpful to relieve the wood around the lead: drill a very shallow recess directly into the lead with a Forstner bit slightly larger than the lead itself (fig. 5). (The entire lead could be drilled out but this is time-consuming and creates lead shavings, which are unpleasant and hazardous.) Drilling to a depth of 1/32", or 1 mm, is sufficient. This releases the contact between the lead and the edges of the hole in the key, which are most likely to splinter.

Figure 4



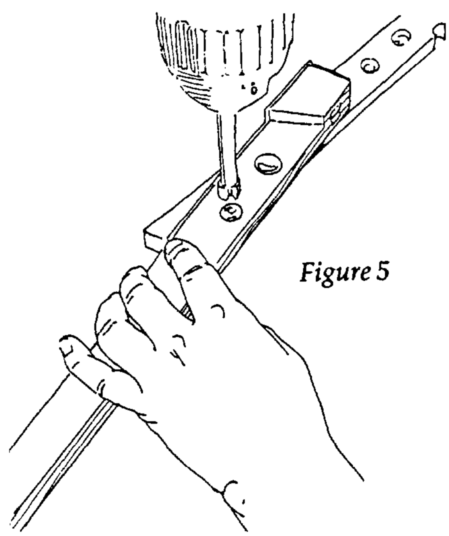


Figure 5

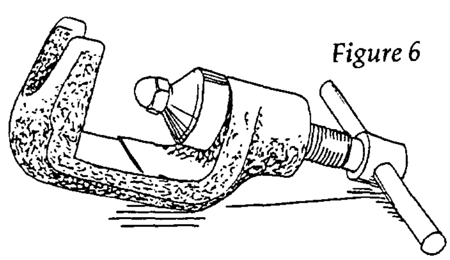


Figure 6

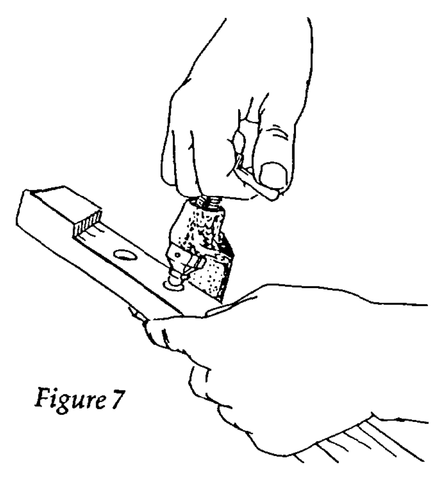


Figure 7

If driving the leads out still splinters the key, press them out instead. My tool for this is a standard hardware store pipe-flaring tool, modified by attaching an acorn nut to the pointed end with super glue (fig. 6). The nut simply creates a flatter, broader contact point. Something similar could be done with a c-clamp and a block of wood with a hole drilled in it to allow the lead to pass through. The slow pressure from a screw-type driver is less likely to damage the key than is driving out the lead with a punch and hammer (fig. 7).

A first-class job calls for plugging the holes left in the keys; it may also be necessary to allow re-locating new leads. Whether plugging the keys has any effect on strength or weight is arguable.

Conventional dowels are not suitable plugs, since the grain orientation will not match the key. Cut plugs from spruce stock or old keys (those birdcage parts finally come in handy...). Moisture content of the key and the plug stock should match; align the plug so the grain is parallel to that of the key. After the holes are plugged, reassemble the action and mark the keys for any re-leading necessary to establish the desired down-and upweight.

Lead on both sides of the balance rail: jiffy leads: Use of the word "never" is asking for trouble, but, as a rule, there never should be lead on both sides of the balance rail. The common exceptions are found in some vertical or extremely small grand pianos which require such leading to assist in key return, or in very worn actions which have lead added as a temporary way to increase action weight and resistance. In general, however, if it seems that an action needs lead on both sides of the balance rail, there is some other problem which should be solved instead.

If it is necessary to lead both sides of the balance rail, or if other circumstances suggest that the leading is temporary (an action with rebuilding in the near but not immediate future), jiffy leads may be an appropriate solution. These are the screw-on leads sold by our suppliers. They can easily be cut in half with a hacksaw (whole, they are usually too heavy) and fastened to the key, preferrably on the underside. I put a spot of glue (wood glue, not epoxy or super glue) on the lead as well as screwing it in place, to insure a buzz-free installation.

Re-leading keys is not a cure-all for action problems, but it is a helpful (sometimes vital) tool in the technician's arsenal. The ability to successfully reweigh indicates a good understanding of the relationships involved in an action: like much of our work (self-taught), it is wise to start small, analyzing and learning from the results as one goes. The technician who wishes to do high-level action work and rebuilding will benefit from developing skill in this area of piano service. I cannot emphasize too much that leading is not a cure-all (personally, I have never purchased a jiffy lead—I get all I need removing them from actions with sluggish centers, expanding brackets and other unsolved problems...) but it need not be shrouded in mystery. As we develop as a technical field and as individual technicians, understanding this aspect of piano function becomes an integral part of our work.

Tips, Responses, and Newsletter Reprints

The Forum continues with a couple of useful little hints, a Better Way response, and a short article on the diagonal bar which is actually a two-part discussion from Kerry Kean and Ken Sloane of the Cleveland Chapter. This last originally appeared in Butts and Flanges, the chapter newsletter, and was also included in one of the issues of the College and University Technicians' Committee newsletter. Both are excellent and informative publications and are highly recommended (and you can expect more reprints from them in the future). My heartfelt thanks to all contributors!

Some few years ago a contributor to the Journal suggested a longer wire mute handle so it could be used in inserting the wool felt temperament strip. I made several, and have been using them with much satisfaction.

However, in pushing sometimes rather hard to get the felt between the tricords, the hand would slip. Recently, I thought of the enclosed idea: putting a shoulder bend in the wire to rest the thumb on. (Figure 8) I have been pleased with the results, and wanted to pass it on to other technicians.

Best Wishes,
Leroy Fritz

Several times in the past I have seen different methods of doing something, most of which are educational. Sometimes it seems people are proud of the complications they display—for example, gluing hammer shanks and other dowels. I have seen several methods of knurling the shank and/or providing a glue escape groove.

My method is simple and quick. I use a standard pair of pliers with deep grooves in the jaws. The width of the jaw is about equal to the depth of the hole in the hammer head and/or butt. When I am ready to glue the shank, I simply grip the shank on the portion to be inserted into the hammer head, twice, once each at a 90 degree rotation. The result is a 360 degree knurling of the shank. Eight to 12 glue escape grooves is the result. It is quick, and requires no elaborate tools to be bought or made.

Sincerely,
Gene Black

Is There A Better Way?

In answer to name witheld by request on a better way to remove plastic elbows without breaking out the side of the wippen, I have used Frances Mehaffey's Capstan Regulating Pliers (#10 2M, Pacific Piano Supply) with much success. One still must be careful, but the cutout in the pliers seems to fit the broken part of the elbow better than regular needle nose pliers.

Best regards,
Al Seitz

Vince Chambers, new member of the San Francisco Chapter, has success removing elbows quickly by first freezing them with a shot of freon, available in aerosol cans from electronics supply stores (such as the larger Radio Shacks). He reports that they then shatter easily from a light squeeze from a needlenose pliers.

What's A Diagonal Bar?

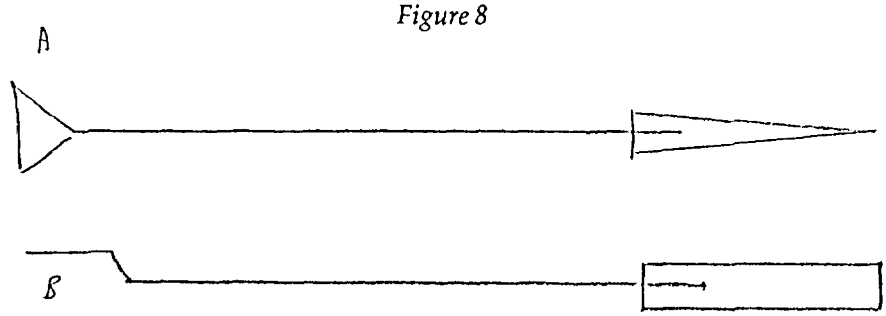
Kerry Kean

What *is* a diagonal bar? Something John Cage dreamed up to notate one of his compositions? A place where you have to watch the go-go dancers at a 45 degree angle? Until recently, if you'd asked me that question, I would have mumbled something similar or worse, although I've seen dozens of them and so probably have you. The diagonal bar is actually that curious, detachable part of the plate found on Steinway Models D and B. Shaped basically like the other plate bars, only upside-down, the diagonal bar does serve a purpose beyond frustrating attempts to work on the lower tenor dampers on large Steinways. It also can, in many cases, be removed with the piano under full tension (pleasant surprise?).

Gary Shipe, of State University of New York at Buffalo, nudged my curiosity at Toronto when he mentioned that some of the people at his school were routinely removing the diagonal bar from the concert grands in order to more easily "prepare" the pianos, and he wasn't sure whether or not to be concerned. Like me, he had probably automatically classified the diagonal bar along with the nose bolts as something that you don't mess with while the piano is under tension, unless you have a fondness for very loud and expensive noises. None of the other techs nearby knew the answer, either.

Sometime later, after the dust had settled from the trip, I called Bill Garlick at Steinway and asked him about the di-

Figure 8



Clothes hanger wire works well. I use a hammer on the flat end by "A" to make it thinner.

agonal bar. Its intended purpose is to act as a "lateral prop," helping to hold the hitch pin web and tuning block web rigidly in place; in truth, it seems to be more of a safety or back-up unit. Bill said that the bar appeared very early in the history of the large pianos (the patent date is 1875); in fact, the D and the old C models originally had a second removable bar in the treble area which apparently didn't survive the evolutionary process.

I also asked about removing the bar under load and Bill's opinion is that if it is possible to remove the machine screws holding it, then the bar is not under any appreciable tension anyway, so temporary removal should not present a problem. Ken Sloane, head technician at Oberlin College and a noted collector of arcane knowledge, tells me that he has removed the diagonal bar from pianos for extended periods of time without ill effect.

I myself am not so bold as to leave the bar off for long, however. I worry too much about a sudden humidity change making it impossible to reinstall without completely lowering the pitch, or even causing the plate to crack. Actually, I'm more afraid that I will lose the silly thing somewhere in the nether regions of my shop, making it altogether too easy for the next technician to work on those tenor dampers.

(Kerry Kean, RTT, is the piano technician for the School of Music at Kent State University. He is also a member of the College and University Technician's Committee.)

I enjoyed Kerry Kean's article about the removable diagonal bar in Steinway's larger grand pianos and would like to comment on his reference to a statement I made about this interesting structural (debatable) member. I also enclosed a copy of a printout I received at a pinblock class taught many years ago by my friend and respected technician, Willis Snyder. (Figure 9) It appears to be something originally printed by Steinway for reasons of nomenclature. As the copy under the picture of the "D" plate relates, "This 'Diagonal Bar' is for stiffening the plate. It is put on after the third chipping and after the dampers are installed."

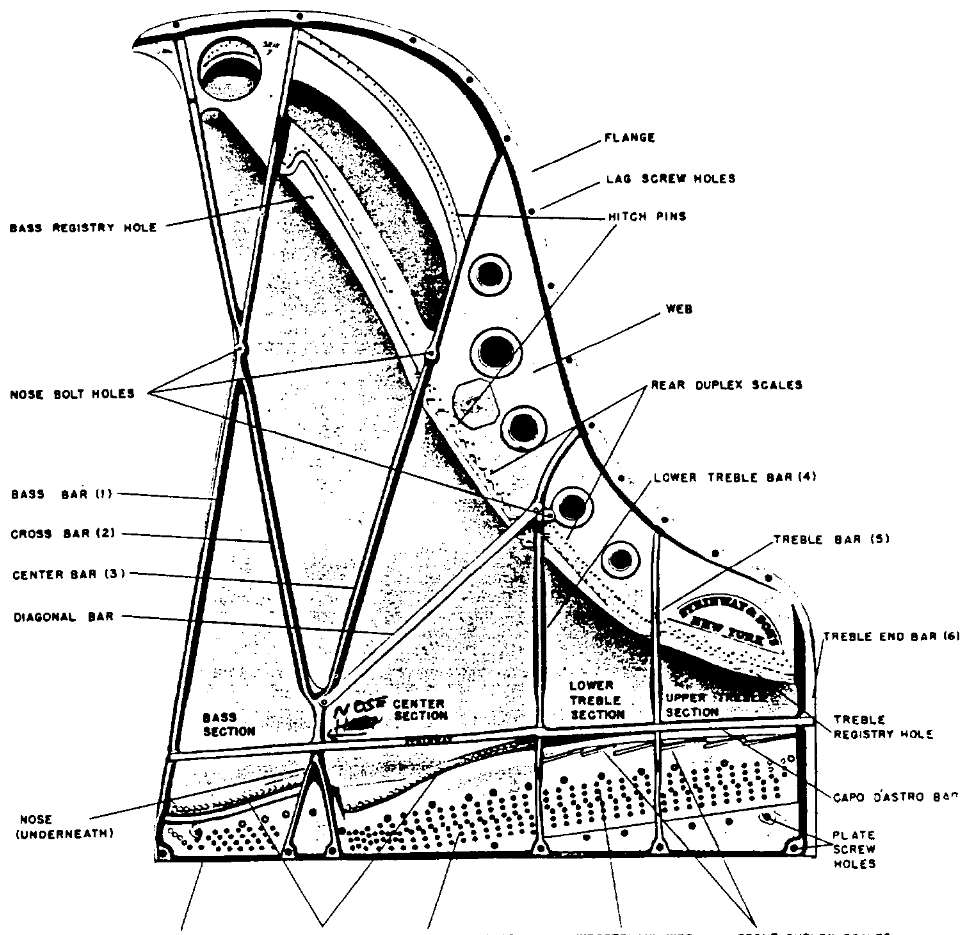
Obviously, Steinway finds it "safe" to bring a piano to pitch without the diagonal bar in place. I agree with this, and my rebuilding process involves several chippings prior to damper installation without the bar in place. I also will take off the bar if removal of the dampers it covers is necessary. I will not allow pianists to remove if for preparation of the piano, exciting the strings with fingers or other objects, etc. because of the precedent it could set.

In regard to engineering rationale for the bar being there, I have been told that in those areas where its termination occurs, the joining of several plate members presents a cooling problem during casting that creates a potential weak spot. In theory, the diagonal bar, if fitted correctly, (snugly) between the terminations, will add some stiffness to these "weak" areas. In several newer Steinways, however, I have found the bar to be fitted only to the top of the plate with no bearing between the sides of the plate members and the end of the bar. In cases like this, the small 3/16" machine bolts that pass through the ends of the bar and are threaded into the plate are the only parts of the system attempting to "lock" the stiffness of the bar between the plate crossbars. Good luck, Charlie. In the older Steinways from which I have removed the bar, the ends of the sides of the plate crossbars where the bar was to be mated (and also the top of the plate and underside of the bar) were precisely ground to fit to one another closely—so closely, in fact, that the bar had to be gently encouraged into place with a rubber mallet, the friction of the tightly fit ends literally locking it in place. The small bolts, at this point, are merely a precaution to keep the bar from coming loose.

In closing, I do consider it wise to keep the diagonal bar in place except in those situations as outlined above. If nothing else, it will add stiffness to potentially weak areas of the plate when it (the plate) is subjected to unusual stresses. For example, a plate may experience torsional stress when a piano is turned on its side for a move or it may distort if subjected to wide temperature extremes during a move. I don't know, but let's leave it there just in case.

Ken Sloane

Figure 9



Reality Check

Among the numerous comments and suggestions I get about the *Journal* is an observation from Kent Gallaway that we are often guilty of presenting a "best case" scenario. Simply stated, this is the supposition that doing everything right will yield satisfactory results. As Kent points out, operating under this assumption can be hard on the ego, particularly of the novice technician.

It simply isn't so: the piano is a complex thing, capable of endlessly demonstrating the innate perversity of inanimate objects. In this day and age, it is an anachronism: a machine made of wood, leather and felt with just enough metal to keep it intact. It reacts to weather, it wears out and breaks in unpredictable ways and it can be unexpectedly wonderful or terrible or both at once. Working on it is largely skill but also art, patience, a little magic and sometimes a lot of good luck. Thing *don't* go the way they should: that is the foundation of our business. It can be a struggle; in presenting material in the *Journal* with some air of optimism, I don't mean to suggest any differently.

Survival tips? Keep a sense of humor, learn from mistakes, and never be too proud to ask for help—and (could you see it coming?) don't miss the annual international convention in Portland!

Tuning Up

Letters

Rick Baldassin
Tuning Editor

Our first letter this month comes from Virgil Smith, of Chicago, IL. Virgil writes:

Thank you for printing parts of my last letter. I enjoy so much the stimulation that results from sharing ideas. I have no problem with your answer concerning the relative speed of 4ths and 5ths with a common top or bottom note as long as it is understood that the 4th is faster than the 5th. We seem to agree that in tuning a temperament the final result, not the method, is important, but that some approaches may be more efficient than others. Also, we seem to agree on the importance of the minor 3rd in temperament tuning. However, I still have a question about the possibility of beats between intervals other than the unison. Since you did not challenge the statement, I am assuming that you agree that the pitch heard when the note is struck is different than the isolated fundamental and any of the partials and cannot be measured electronically. I have two questions: 1) What is the criteria used to determine the best octave if matching partials are not the answer and there is no beat between the upper and lower note octave? 2) Where does the beat originate that I use to determine the best octave? When partials are matched to produce a 2:1, 4:2, or 6:3 octave, I hear a slight roll like a beat between the lower and upper pitch of the octave, but when I stretch the octave a trifle more the beat disappears into a straight line like a solid unison, but then there is a slight beat between the matching partials.

The so-called "pitch" heard when the note is struck is not different than the fundamental and any of its partials, it *is* the composite of all of them, all of which can be measured accurately. Our brain assimilates them into a tone. Even if certain partials (like the fundamental) are not present, our brain still recognized this tone because of the placement of the partials. Let us look at an example.

Partial		(1)		(2)		(3)		(4)		(5)	(6)
Note:		**C2**		**C3**		**G3**		**C4**		**E4**	**G4**
Note:	C1*	C2	G2	C3	E3	G3	A#3	C4	D4	E4	G4
Partial:	(1)missing	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(12)

*Fundamental of note C1 missing

In the above example, the frequency of C2 is the lowest audible frequency for both notes because the fundamental of note C1 is missing. Yet our brain hears one note an octave lower than the other. Why? Because note C1 has a partial at the pitch of G2, and note C2 does not. As you can see, all of the odd partials for note C1 are located at frequencies where note C2 has none. For this reason, our brain hears the note an octave lower. This principle is present in telephone communications, as well. Telephones do not reproduce frequencies below 300 hz, much lower than the telephone can reproduce. Yet my voice sounds much lower over the phone than my wife's voice does, for the very reason given above. My voice has overtones atfrequencies which my wife's voice does not. The brain of the listener discerns this, and hears my voice as lower, even though 300 hz is the lowest frequency being reproduced in either case. In the piano, inharmonicity plays a role. The more inharmonic the note is, the harder it is for our brain to assimilate all of the partials together as a tone. This is why in many spinet pianos, we do not hear the very low notes as tones, but just thuds. They are too inharmonic for our brain to handle.

Any of the above partials can be measured electronically. It is true that only one partial can be measured at a time (unless you have several measuring devices), whereas our ears hear all of the partials which are present, with sufficient amplitude, simultaneously. The fact that the electronic device only looks at one partial at a time does not change the "pitch" of the note. In fact, other than providing a reference to start from (A-440), pitch has very little to do with piano tuning.

In conclusion, the tone we hear when the note is played is a composite of all of the partials which are present. I fail to see how this concept is compatible with the concept that the pitch of the "whole tone" is different depending on which part you are looking at.

As to what criteria are used to determine the best octave, the answer would have to be the placement which produces the best sound between the two notes of the octave, tempered by the placement which produces the best progression of intervals. Tuning aurally, the object is to try, as much as possible, to eliminate beats in the loudest set of partials, while at the same time minimizing beats in the neighboring sets of partials. Once this is achieved, then the progression of parallel intervals, such as 10ths or 17ths, is tested. If everything checks out, then fine. If not, then a decision must be made either to favor the octave sound, or progression of intervals. When octave tests are used aurally, the effect is to isolate a particular set of partials. The set being isolated depends on which test is being used. Let us look at three of the most common octave tests to discover which partials are being isolated, and why.

A very common octave test used to tune the bass is the m3-M6 test. Some months back, I listed the ratios for the intervals used in piano tuning. You may recall that the ratio for m3 (minor third) is 6:5, and the ratio for a M6 (Major sixth) is 5:3. Since the 5's are common to both ratios, the test isolates partials 6 and 3, and the m3-M6 is the test for a 6:3 octave.

Another common test, used extensively in the midrange, is the M3-M10 test. The ratio for a M3 (Major third) is 5:4, and the ratio for a M10 (Major tenth) is 5:2. Once again, the 5's are common to both, so the M3-M10 is the test for a 4:2 octave.

A test used in the treble is the M10-M17 test. The ratio for a M10 is 5:2, and the ratio for a M17 (Major seventeenth) is 5:1. The 5's are common to both, so the M10-M17 is the test for a 2:1 octave.

Since electronic tuning devices can be set to isolate certain pairs of partials, the same results can be achieved as if the aural octave tests were used. The real question is, will this create the best sounding tuning? Maybe not. Experience has shown that minor variations, which have little effect on the sound of the octave, can greatly improve the progression of parallel intervals. This is why the progression of the Major 3rds (5:4), Major 6ths (5:3), Major 10ths (5:2), and M17ths (5:1) should be tested when using an electronic device. This is how we test whether the partial matching we are using is working.

Above, I explained that in the bass, the fundamental is quite often absent. With this in mind, I think we can safely dismiss the notion that beats occur between the fundamentals of octave notes. How can the fundamental of a note, which is not present, create a beat? It cannot. The beats occur between these pairs of partials (2:1, 4:2, 6:3, etc.). Often, we hear several pairs at the same time. As tuners we try to eliminate the loudest beats, while at the same time minimizing the other beats. Sometimes, this means that none of the pairs are tuned beatless, but all are beating very slowly, almost not noticeably. Recently, while teaching at the New England/Eastern Canada Regional, I conducted an experiment to prove whether the concept of eliminating and minimizing beats was true. In the room was a Yamaha C3 grand piano, my Accu-Tuner, Chris Robinson's spectrum analyzer, and a room full of piano tuners with opinions. The experiment was to tune an octave such that the tuners present agreed on the placement for the best sound, then measure several of the partials (2:1 through 12:6) with the Accu-Tuner to determine which partials had been matched and which had been nearly matched, and finally, with the spectrum analyzer, determine which pairs of partials had the greatest amplitudes.

The first octave tuned was from C3 to C2. In very short order, the committee of the whole was able to agree when the tuning was best. Remember, this was judged on octave sound alone, no parallel intervals were used. Measuring showed the octave to be slightly wide at the 2:1 level, virtually pure at the 4:2 and 6:3 levels, and narrow at the 3:4, 10:5, and 12:6 levels. The spectrum analyzer showed that the 6:3 pair had the greatest amplitude. The 4:2 and 2:1 pairs were also prominent. This meant that there was a very slow beat at the 2:1 level, but the 4:2 level was pure, as mentioned. The amplitude levels above 8:4 were not as great, so the beats produced were not very audible. This was dramatic proof that this group was happiest when the loudest beats were gone, and the neighboring beats minimized.

The next octave tuned was from C2 to C1. After several minutes, the group could not decide where the octave sounded best. When part of the group felt the octave sounded good, another part of the group would say it sounded awful. There seemed to be at least three factions scattered around the room. We finally agreed that it didn't sound good anywhere, but found a place which was least objectionable. It turned out to be tuned between 8:4 and 10:5, such that the beats at 6:3 and 12:6 were about equal. The spectrum analyzer showed all of these beats to be very audible, which was why there was not a concensus as to placement: the beats could not be eliminated. The reason for this is simple: the inharmonicity of the lower string was much higher than it needed to be. The steps in the double wrapped string were over an inch long, which is much longer than necessary. This excess inharmonicity made it impossible to eliminate any of the beats and still minimize the others, so the octave sounded bad no matter where it was placed.

From the above, we can see that partial matching, or elimination of the loudest set of beats, is the main criteria used to determine the best octave. Sometimes the beats cannot be entirely eliminated, but are then minimized as much as possible. When there are several loud and incompatible beats present, there can be no placement which sounds good, tuning by ear or with a machine.

As to the origin of the beat which Virgil uses to determine the best octave, it would be impossible for me to say without actually listening to what Virgil is doing when he tunes. I am afraid what he is actually doing is not what he stated he was doing when he stated earlier that he could tune an octave 2:1, 4:2, or 6:3, and still hear a slight roll between the upper pitch and lower pitch of the octave, but when the octave was stretched slightly more, this "beat" disappears, but then there is beating at the matching partials. According to this, he would be tuning the octave wide of 6:3, which would make the octave wide at the 2:1 and 4:2 levels as well. This might work in the bass of the piano, but it certainly wouldn't work in the treble. The octave would be too wide. I do not believe that there is a beat between the lower pitch and upper pitch of the octave, as Virgil does. I believe the beat which he refers to as coming from the pitches of the upper and lower note, represent the loudest set of partials present. I believe the other beats which he refers to are the sets which still beat when the loudest beat has been eliminated. Since all of these beats are heard at the same time, it is sometimes hard to differentiate between them, without isolating particular sets by the use of octave tests, or an electronic device.

The problem here may be one of semantics, the result of using terms to define what we are doing, whose meanings have changed with time.

Summarizing, beats in the octave come from coincident partials. Our ear hears all of these beats at the same time. We can isolate these beats either by using the octave tests listed, or with an electronic device. While it is true that the electronic device can only listen to one set of beats at a time, this is generally not a problem if the tuning device is set to duplicate the same partial matching (or near matching) as would be done by ear.

Our thanks to Virgil Smith for yet another letter raising questions for discussion in this column. Our next letter comes from Ron Berry, our President. Ron writes:

In the April 1989 issue of the Journal there was a letter from Patrick Poulson recounting his experiences using the stretch calculator mode on the SAT during a tuning test. He had scored poorly because the stretch calculator was producing overly wide octaves. This highlights a weakness of the stretch calculator which can only be assessed aurally. The stretch calculator will always produce a consistent tuning but it can be consistently wrong as well as consistently right. The problem occurs when the stretch number measured is not the best stretch number to use for that piano. If the piano has *an inconsistency when the inharmonicity of the F4 is out of line with other notes, the stretch numbers measured will not be the best one to use. I discovered this when I still used the SOT. The SOT did not have as much accuracy in its internal calibration, and my particular instrument always measured the stretch number at least .5 less than what worked well. I would tune through the temperament area and then listen to the temperament. The 3rds will always progress smoothly but perhaps will increase too slowly or quickly. The 4ths and 5ths are the real test here. If you find that the 4ths beat slower than the 5ths then the stretch number is too low. If the 4ths beat very fast and the 5ths are pure then your stretch number is too high. When the stretch number is too high the effect adds up to octaves that are overly wide. This points up the need to not depend totally on the instrument and the need to use your ears.*

The instrument is excellent at keeping consistent from one note to the next, but you need to determine aurally when it is running ahead or behind on beat speed increases. This is true when using the instrument for octave tuning. In the bass, for example, you determine aurally whether pure 6:3, wide 6:3, pure 3:1, etc. is the best interval to use. You then use the instrument to consistently produce that type of octave. You must, of course, check every few notes to see that that type of octave is still working well and adjust accordingly.

While Mr. Poulson's case may have some other cause, I know that this problem can exist. By measuring the stretch number on E4 and F#4 you can see if it matches that of the F4. Above all, don't turn off your ears when using the instrument.

This is very good advice. Since I published this in the April issue, I have learned some interesting twists in regard to this story. First, as I speculated, the master tuning did favor narrower octaves. I have no problem with this. No one has ever claimed that every committee would produce the same master tuning. The next matter was that readings were hard to take on this instrument. This made it harder to measure the stretch number accurately, as well as record the master and test tunings. I also learned at some point, this piano had been re-scaled. I have no problem with this. The piano could still be tuned smoothly, as evidenced by the applicant's passing of the aural portion. It does point out why this experience with the stretch calculator was different from my own experience using the stretch calculator on the same make and model. All of these factors led to the failure of our applicant. This, however, could have been avoided if our applicant had listened as much during the electronic section as he did during the aural section. Ron's suggestions for confirmation of the stretch number by measuring neighboring notes to see if the number measured on F4 was in line with these neighbors, is a good one. The aural tests which he mentioned are also a good way to determine if the correct stretch number has been chosen.

There has been much said here about the weaknesses of the stretch calculator which showed up in this particular instance. In fairness, I must say that many pianos are quite successfully tuned each day using this system. The moral is, indeed, to listen and test constantly whether tuning aurally or with a tuning aid.

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

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At Large

Efficient Tuning, Part II

Charles P. Huether
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The tools of the piano technician are many. Those used for tuning are actually very few: the tuning lever or hammer, some wedges, a temperament strip, a tuning fork or other pitch source, and perhaps a screw driver. Add to this list the most important one, yourself. We spoke a bit about yourself earlier, but one cannot eliminate reference to the tuner when discussing the tools and methods of use.

First, a few generalities relating to all tools. If you are like me, you will notice that you have a great bunch of tools which you never use. Some are quite fancy and some simple looking. For the most part, they were purchased or made to cover some aspect of our work which we were having a hard time accomplishing.

How come they are languishing in an old toolbox unused? My theory, with apologies to everyone who has ever invented or developed a "short cut" tool (myself included) is that they usually don't work as well as the old tools do, once you really master the old one. As we grow better and more proficient we discard the "new" invention and revert to the old one and do the job faster and better without the extra burden of lugging an additional tool for months, if not years, between uses.

Tuning levers, or hammers, have not changed much over the years, except to grow heavier and bulkier. There is one exception to this minimal change, and it is the star tip. With the advent of the star tip one had a more convenient unit which could be applied to the tuning pins with a minimum of change in hammer angle—one of those simple ideas which makes one wonder why it had not been thought of much earlier.

Another radical development in tuning levers is the impact hammer. Many people swear by this unusual instrument, but for some reason I have found it difficult to handle and master. In addition, I have an aversion to carrying around too much hardware and weight, so I am content to carry one hammer instead of the two which are necessary if one uses an impact hammer.

Finally, in recent years there has been a lever which appears somewhat radical which uses a round knob at the end of the handle. Being the developer of this type of unit, I am reluctant to present its advantages (as I see them) knowing very well that there must be a lot of people out there who disagree with me. Ask me about it next time we meet.

Regarding tips and heads, however, there is much to discuss. I have always preferred an extra short head, using one with a 15 degree angle to provide the necessary height to get over struts, etc. When that does not suffice, I will get up and move around so that it will still do the job without changing heads. I dislike changing heads.

It is my feeling that a considerable part of one's technique is related to the feel of the tuning lever and pin contact. Changing parts creates a different feel each time, and can confuse the tuner.

More crucial is the tip and its relationship to the tuning pin. For many years I have been asking people who I assumed to be knowledgeable, what the dimensions were for different sized tuning tips. The answers I got were all brief, non-informative and confusing. The best answer I got was: "#2 tips fit #2 tuning pins." Not satisfied, I did a little research, and found out three things:

1. Tuning pins are not standard. If you check some old tuning pins you will find that the beveled top of the pin varies considerably from manufacturer to manufacturer. The length of the swedging and the pitch of the taper differ.

2. The swedging is not always even, so that you can take a tuning pin and place it in a tip in eight different ways and get a different feel with each setting.

3. Because a tip fits well on a pin does not mean that it is grasping it down low.

This last point is the most important. Since the match of the tip to the pin is between two tapering units, one cannot see where the contact is being made. If one uses a #3 tip, as is often recommended for speed, the fit is quite loose, so much so that when one turns the pin the tip angles and is grasping the pin at the top on one side and the bottom on the other, a perfect way for bending or distorting the pin and/or pin block.

I began measuring the depth of the cut in the tip and found that it varied a great deal from tip to tip, and that this variation coincided with the difference in feel for each tip. Essentially, the large one-piece combination head-and-tip units were the poorest. There was one exception, the smallest one-piece-head and-tip. Because of its shortness, it had the shortest fluted inside, and to my mind, the best fit of all.

There is a variation in tips from maker to maker, so I would suggest, if you would follow my ideas, that you buy your tips in person, perhaps at a convention where there are several suppliers, and bring along a tuning pin to try them out.

Tuning pins are a bit more standardized today for several reasons. One is that piano makers require more standardization so that they can be used with stringing machines. Another is that there are fewer manufacturers. However, until we dispose of about two million old instruments, we will still have the situation where pins are so different that longer pins sometimes have less working length than shorter ones. Jack Krefting wrote about this several years ago.

Strip mutes come in different lengths. Once exclusively called Temperament Strips, the advent of strip muting the whole piano while tuning has made that name obsolete. One needs strip mutes of different thicknesses, since the spacing of strings differs from instrument to instrument.

Using a strip which is too thick will dislodge unisons. If you see some unisons too close together in your next upright, don't blame the manufacturer, blame the tuner who squeezed a mute which was too thick into the space and nudged the string over. Correct it if you can, remembering that if the hammer is grooved, the string will be forced back into the wrong position when played unless the hammer is filed. But be careful not to create more problems than you are attempting to solve. Filing only one hammer can create other problems. The old adage "If it ain't broke, don't fix it" always applies.

For strip mutes I prefer backrail cloth. Being a woven material and having some "tooth," it dampens without excess pressure. And speaking of pressure and moving unisons, please be careful of the damper wedges when inserting your mute. Lift the dampers clear of the strings to prevent damage to damper wedge felt.

One question I have no answer for is: "Where do you put the mute in relation to the overall length fo the string?"

On uprights, this is usually close to the bearing bar, out of necessity. On grands it can be out beyond the dampers, further along the length of the string. Does this make a difference in harmonic generations or in interfering sympathetic vibrations? Is it possible that the different location of the strip mute is one reason why uprights are sometimes harder to tune than grands? If anyone has a theory or actually "knows" the answer, I would be happy to hear it.

Wedges are usually rubber or felt. Rubber ones come in black, white or red. I like the colored ones for they are more visible when working in the inner recesses of some uprights, but for some reason I do not know, they seem to wear out sooner. If seeing the damper in the dark is a problem, you can use the old Larry Sheer system and paint the tips with some white typing correction fluid. It wears off in time, but you just repaint it.

I have two sizes of rubber mute, each pair with a different color handle for easy identification. One pair has the thin tip trimmed and it works well between notes. It does not require a fine tip. I found that too fine a tip tends to curl and often bends while inserting between notes. Without the fine tip, it slips in and out faster and better.

The other pair has the fine tip, but I have reduced the width of its working length, keeping the top where the wires go in full sized. These work well at the top where the dampers get in the way and where one sometimes needs to insert the wedge between unisions.

Paps mutes and other unusual kinds I have never mastered. I look for simplicity and something which works well and consistently, without too many variations. What I want is quick operation with minimum of time lost.

I have come to the conclusion that one tunes only about thirty percent of the working time. The other seventy percent of your time is used manipulating your tools. So develop a system which is efficient and reduce the time spent. Fast tuning does not necessarily have to neglect the actual tuning if it develops its speed by efficient use of one's tools.

The most important tool we have is our own body. How we use it is the ultimate factor in how well we work. I have rarely seen a picture of a piano tuner where that tuner is sitting in an appropriate way to provide maximum energy efficiently to his task.

If there are 20 tons of string tension in a piano, we can reasonably say that after we finish tuning an instrument we have lifted 20 tons. Five a day, and we did more work than a coal miner. And all by hand. Don't underestimate the effort and stress involved in what we do.

It is common to sit square to the keyboard while tuning. This is fine for the most part on a grand, but for an upright, it provides the greatest stress and distortion in arm movement possible. The arm was made to provide maximum efficiency with a forward and backward movement, not to move side to side, and to jab, not to throw haymakers. Sit at the piano sideways, lean into the instrument a bit, and working off the top of your tuning hammer, push it forward or draw it back.

Whoever said that one should practice turning the tuning pin until one was sure that they could make 250 incremental movements in one quarter turn was right. It takes very little movement to change the pitch. To achieve satisfactory results by going up and down again up and down until you hit what you hope is your mark is the perfect method for creating instability.

While sitting at the bench, sit on it squarely, feet on the ground. Move the bench as you move up or down the keyboard. Don't shift your position back and forth so that you are sitting on the edge of the bench. You will be catching the leg nerves, even affecting blood circulation. When you feel your legs getting tingly, something is wrong.

Reducing fatigue, stress and tension will improve your speed and the quality of your work. Since you are only selling your time, your earnings should grow.

The only problem you can develop by going too fast is convincing the customer you did a good job. But look at it this way; you will have more time to relate to the customer and the instrument. This is when you develop the respect and acceptance which will be the basis for further work to improve the instrument. Time spent assuring and reassuring the customer of the validity of music and the piano as child development tools and as adult enjoyment is well spent.

Next month we will look at structural consideration and methods for tuning the piano. ≡

Good Vibrations

Bearing, Bridges And Bonanno

Nick Gravagne
New Mexico Chapter

Applying downbearing to a soundboard during stringing is like building a house on a sinking foundation—nothing seems certain. Actually, there is more which is certain than not. All foundations sink under the weight of downbearing. As long as the sinking is not excessive, and is more or less uniform, there will be no negative consequences—a vital fact when understood first-hand, much to the chagrin of Bonnano Pisano, the engineer in charge of the construction of the Leaning Tower of Pisa.

If the weight (or force) exerted on any system is normal and acceptable for the application, then the amount of sinking is a function of both "strengths of material" and the geometric configuration of those materials. In the case of a house the materials may be concrete, blocks, steel, and the earth itself; and the dimensions, configuration and interaction of these materials play a crucial role in the ultimate stability of the structure. The conditions in the belly of a piano are essentially the same. The materials under consideration are hardwoods, softwoods, and iron or steel, all with their inherent strengths. Again, the arrangement and adjustment of these items determines the performance, ultimate stability and longevity of the instrument.

It is no secret that some foundations and some soundboards sink more than others under a given load. In addition, it is entirely possible (and oftentimes true) that load bearing systems of all kinds are either overbuilt or underbuilt, having a profound effect on that system's behavior when placed in service. For the moment we are going to have to assume that a typical soundboard, given that it is made of spruce, crowned to somewhere in the neighborhood of a 60 foot radius and rigidly affixed at its dense perimeter, is properly designed to support the load placed upon it. But all things considered, how are we as rebuilders supposed to understand and interpret what is happening when stringing a piano over a soundboard which continues to sink? Why bother with all that careful work in setting a consistent angle of bearing if, with the addition of each new string, that angle is slowly but surely doing a vanishing act? These questions, along with certain implications, can best be answered by outlining some shop practices regarding setting the bearing.

Practical Downbearing

Last month we discussed setting a plate on new dowels over a new soundboard which had new bridge caps—it is now time to set the bearing. Note that the bearing may be set—that is, the plate positioned (perhaps simply according to its original height), the downbearing angle determined, string tests made, bridges kerfed—*before* or *after* the plate support dowels have been installed. This depends on your preference and experience. Realize, though, that efficient rebuilding requires handling the plate as few times as possible. As explained last time, I prefer to set the bearing before the dowels have been installed as it requires one less plate installation—no small consideration when working with a concert grand.

Let's imagine that our piano now has the new soundboard, the too-tall bridge caps, the new pinblock, and that the plate has been temporarily installed so that it is secured to the pinblock with some of the screws and is also resting on a couple of nosebolts. The support dowels may, or may not, have been installed. If the Baldwin suspension system is being used, the special all-thread screws definitely will *not* have been installed. So where do we go from here? First, an angle of downbearing needs to be decided upon.

Since I have already written articles which deal with downbearing angles—what they are, the relationship to pressure on the soundboard, how the angles relate to simple dimensions at the rear string rests—I won't go into that kind of detail here. Please refer to the March, April, and May '88 *Journal*, this series—especially the May article entitled "Finding Dimension V"—for additional information. Still, in order to keep a modicum of continuity at this point, a few simple concepts will be reviewed.

Much has already been said in favor of 1.5 degree angle of deflection, tapering off to about one degree or less at the low end. These bass angles will diminish due to twisted core wires at the hitch area, understringing cloth, and soundboard compression in general from the treble bridge.

The dimension at the rear string rest which relates to a 1.5 degree angle is the product of the rear string length (as measured from the *front* bridge pins to the rear string rest) and the factor .026 (which is the sine of the angle). (The factor for a one degree angle is .017.) For example, a rear string length measuring seven inches works out as seven times .026=.182 inches, which is about 3/16 inch and is the required height of the test string over the rear string rest for that area of the bridge. Remember, shorter rear lengths will relate to smaller dimensions above the rear rests, but the angle will be the same everywhere. Of course, since the bridges will be tested and kerfed in several places, the required multiplication will also have to be figured several times—which is why I prefer the simpler and faster geometrical technique (with simple, handy drawing) explained in the May '88 *Journal*.

Uniform pressure on the soundboard can only be hoped for if the bearing angle is the same at all the unisons along the bridges. The idea is that all the strings should be pressing on the bridge with the same force. This tends to insure both uniformity of energy transference as well as a more stable piano through

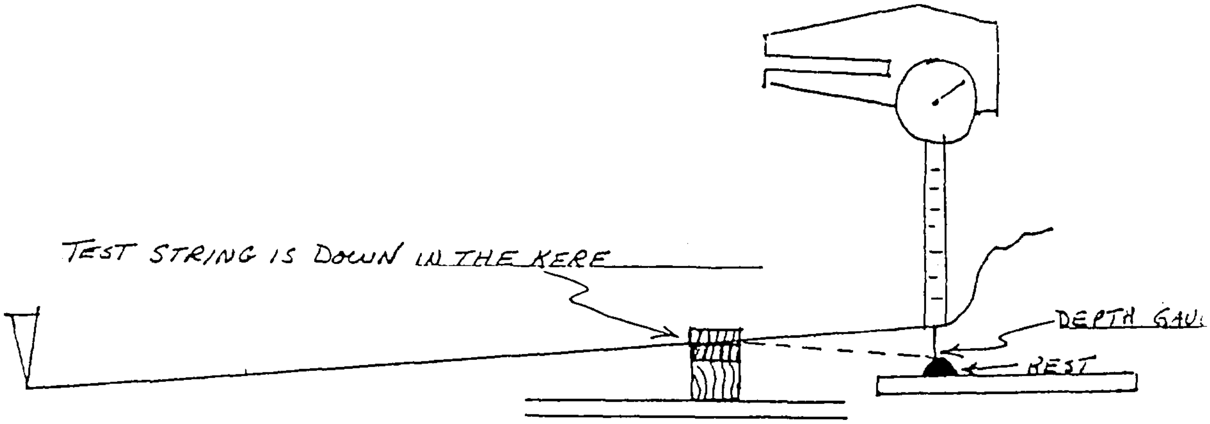


Figure 1
Test string is held secure to underside of the calipers stem as indicated in the drawing. The depth gauge is adjusted to the proper dimension. Raise and lower the taut string and gauge as one unit. Keep a sharp eye to see where the string just makes contact with the bridge. The bridge needs to be kerfed until the string and depth gauge simultaneously make contact with the bridge and rear rest respectively as indicated in the drawing. The dashed line defines the downbearing angle.

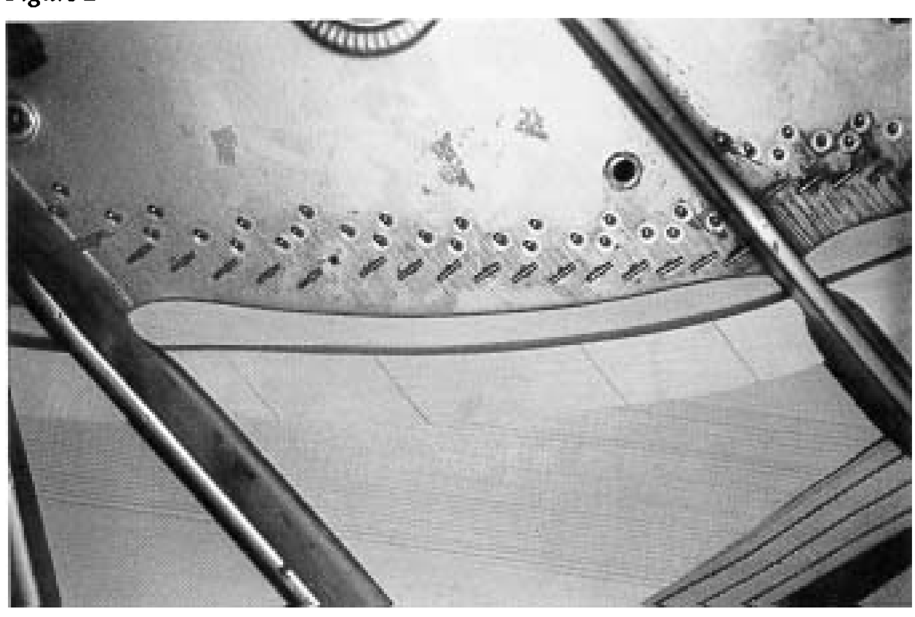
seasonal changes.

After the plate has been lowered into place it should be secured at the pinblock with every third screw (or so), and secured at the nosebolts with the nosebolt nuts. Since the bridge caps are too high there will be too much bearing which is what we want. With the aid of a carpet thread or light weight fish line, the familiar procedure now is to kerf the bridges at several places with a small saw until the test string is the correct height above the rear string rest. This process actually defines a downbearing *angle*. If cloth strips are going to be cemented to a continuous cast-in string rest, they should be available for this procedure.

Figure 1 shows both how to make the string test and measure the required height above the rear rest. The dial calipers shown are ideal since it has a depth gauge feature. To set the dial gauge for a downbearing dimension, make the required multiplication as explained above (or dig out your geometrical drawing) and set the gauge accordingly. If you are working alone, clamp the test string in large tweezers and push the tweezers and string down into a tuning pin hole or an empty screw hole. (No peanut butter on the tweezers, please.) This frees you to work at the business end of things. Pull the string taut over the appropriate section of the bridge and place a short straigh edge (six inch ruler) on the bridge and alongside the test string. Draw a line. This is where the bridge will be kerfed. An excellent saw for kerfing is a small, five and one-half inch tool made by X-acto. The blades are removable and it is handy to have two, a fine tooth and a coarser tooth. The blades cut a very thin kerf, though, making it a bit difficult to see what is going on with the test string. You may want to consider a small saw with a wider blade.

Place the blade perpendicular to the bridge and make a controlled cut along the pencil line. Be careful not to cut the bridge at an angle, by tipping the saw too far forward or backward. Also, try to introduce a "level" rather than rounded cut. Level means parallel to the section of the soundboard directly under the bridge. If sloping the bridge a bit to the rear appeals to you, do so when the bridge is planed, not in this kerfing process. Of course, don't cut down too far. Keep checking with the test string and the dial gauge. This procedure needs to be done at least every six inches (or even closer) along the bridge. Figure 2 shows a photograph of saw kerfs on new bridge caps. Notice that the plate has not yet been cleaned up or finished. The capo bar, however, has been reshaped and polished. If new agraffes are going to be installed they should be in before the bearing is set just to be on the safe side.

Figure 2



When all the saw kerfs have been made the plate can be pulled, the bridges planed down to the bottoms of the saw kerfs, and the bridges finished. Since this is not a discussion on bridge work, the details will have to wait until we get to that topic. Still, I will say this at this point: planing, drilling, notching, and pinning a bridge while it is inextricably secured to the piano can be a real back-breaker. Many rebuilders, myself included, much prefer to do the fine work on the bridges at a more accessible and controlled place—such as the workbench. This, of course, requires that the bridges must be temporarily secured to the soundboard, or that a new soundboard/bridge assembly must be temporarily secured to the rim. Thus, after the plate has been pulled, the soundboard and/or bridges can also be removed for the final bridge work. We'll get to this in due time.

If the work has been carefully carried out, the finished bridge will stand higher than the rear string rests by an amount which will define a consistent angle of bearing. Given equal tensioned scales (more or less) this common angle of bearing also means uniform downbearing pressure on the soundboard. We can say at this point that the *conditions are set* for bulk pressure to be evenly distributed on the soundboard. But isn't it true that this angle diminishes as the piano is being strung? And doesn't that indicate that we won't end up with uniform downbearing? We are now back to the ideas presented in the opening paragraphs of this article.

Bonanno Thought Everything Was OK, Too

It has been said that there is no longer distance than that which exists between the drawing board and the workshop.

Let's imagine a soundboard which is sufficiently rigid so its deflection under the weight of downbearing is so small as to be negligible. That is, if we were to measure the angle after the piano was strung and pulled to pitch the bearing angle would still register 1.5 degrees, In such an instance, the soundboard is not acting like a resilient spring but simply as an immovable support. Given a consistent bearing angle, it is clear that there will be a uniform compressive force along the length of the bridge which will be supported by the soundboard and rim. This force works out to be the product of the string tension, the sine of the bearing angle, and the number of strings. In the case of an average 160 pound tension, a 1.5 degree angle, and 220 strings, the total force on the soundboard equals about 900 pounds.

Now let's imagine an unstrung piano which has a normally flexible soundboard. Let's also imagine that devices such as wedges or jacks or press screw arrangements are positioned under the soundboard so as to prevent it from sinking as the piano is being strung. When the tension is on, the bearing angle will show, as in the case of our rigid board, that no downward deflection has taken place. Finally, imagine that the supporting apparatuses under the soundboard are instantly removed. What will happen? Clearly, the flexible soundboard, acting like a spring, will translate downward under the load since it is now called upon to accept the full force unaided by the additional supports. The bearing angle will no longer register at 1.5 degrees but will be more in the range of 1/2 to one degree. But what happened to the 900 pound force which was there a moment ago? Has it also lessened as the now smaller bearing angle would seem to indicate?

To answer this question, we must remember that *work* introduced into, and stored in any system (such as spring) is recoverable. This is what we call resilience. When the soundboard flexed downward with the removal of the imaginary supports, work was done. You may recall that when work, which is performed by force, is retained somewhere it is called potential energy. This energy is like money in the bank and is payable on demand. And in order for the energy accounts to balance we must accept that energy input must equal energy output. This concept is basic to what is referred to as the conservation of energy (the current flap over cold fusion notwithstanding). So in order for the 900 pounds to lessen there would have to be a release of energy somewhere such as would be the case if the soundboard actually broke apart, or permanently deformed (as opposed to flexing in resilience), or the rims permantly deformed outward. But if nothing of the sort happens, there will be a redistribution of the 900 pounds acting in the three primary stresses—compression, tension and shear. But is that force evenly distributed? Is there anyway of predicting how the soundboard and bridges are going to react to the downbearing load?

It would seem that if we start out with a consistent angle in the unstrung, unstressed soundboard, the angle we measure in the strung piano should also be consistent, only proportionately less. But many a careful rebuilder has found that *not* to be the case. And although the recognition of the problem is plain enough, the remedy is elusive.

If a soundboard were a perfect spring, it would contract evenly all around under the uniform compressive load, hence it would sink uniformly and predictably. The same could be said about the expansion of the rims (which should be neglible). But most soundboards are not perfect springs, nor do they contract evenly, nor is the expansion of the rims anything to play odds on. In fact, if we start out with a consistent angle in the unstrung piano and end up with an inconsistent angle in the strung piano, there is more than a suggestion that the belly system is not responding evenly to the force, nor is it supporting the load uniformly. The bearing angle in one section, for example, may read about one degree while in still another it could appear to be nonexistent. It is important to realize, however, that, unless one section of the bridge completely sinks below the level of the rear string rests (negative bearing), the force of 900 pounds will still be in the system, albeit unevenly distributed. And it will only remain in the system so long as all of the stressed components remain resilient.

So, where the bearing angle in the strung piano varies from near zero to one degree, certain design aspects of the piano come into question. It may be that a few of the ribs should have been designed a little deeper (the width of the ribs have much less to do with it), or maybe some ribs should have been less deep, maybe there should have been twelve ribs instead of eleven, or maybe ten. Perhaps a belly bar in the upper bass corner would abate that tendency for a soundboard to roll. And what about differing crown deflections at each rib as inevitably happens? What about the case, the plate, the inner rim angle and so forth?

There is simply no way for the rebuilding technician to account for all of the variables and possibilities. And even if it were possible, there is little, if anything, than can be done about it. A few thoughts can be added here, however.

Fortunately, for the most part, new soundboards having plenty of crown respond well and with reasonable uniformity under a consistent downbearing angle. I consider a bearing angle in the strung piano within the parameters of 1/2 to one degree to be excellent.

We all know that some soundboard/case/plate systems are underdesigned or minimally designed. A rolled soundboard, or rolled bridge as it is sometimes called, could be a first-sign indication of inherent design weakness. And if we are considering soundboards alone, the single most important component in question is the rib and its depth dimension since these members, acting as girders, support the lion's share of the downbearing load. Thin soundboards with relatively shallow ribs have more of a tendency to roll and hollow out in the large center area, although it can happen anywhere. Soundboards with deeper ribs seem to respond more predictably under downbearing than those boards which have shallow ribs. (In the longest ribs, deep means about one inch and shallow means about 3/4 inch.) When replacing an old board which shows signs of hollowing and rolling, I am inclined to deepen the longest ribs by 1/32 to 1/16 inch along their lengths in front of the bridge. This will have the effect of strengthening the board without making it stiff. I don't consider this to be rescaling. Pianos which have belly bars in the upper bass corner have less of a tendency for the soundboard roll. A more technically satisfying discussion on the forces and reactions in the belly of a piano will be presented in a future article.

If we were careful piano manufacturers, working on and living with the same models every day, certain design and performance idiosyncrasies would surface. Our pianos and processes would then ascend to higher and higher planes of excellence and uniformity as each successive production run avoided the illnesses of the previous generation. The key lies in being alert to what is working, what is not, and why. But we are not manufacturers in the large sense and, rather than working in a relatively narrow arena, we come in contact with a wide variety of instruments. Although this makes things interesting, it can also leave us in a quandry as to what to do in an uncertain or peculiar technical situation. That's why we need to share our experiences.

If I were going to build a tower, I think I would want to chat with Bonnano Pisano before Gustave Eiffel.

See you in Portland. ≣

At Large

More On Tuning Instability

Ernie Juhn, RTT
Long Island-Nassau Chapter

This time I would like to explore some of the facts as well as myths that seem to be regarded as "rules." Let's start with frequency of tuning. We already know that string players tune their own instruments, as do harpists. Most musicians maintain their instruments. Most woodwind musicians make and install their own reeds, pads, etc., and most timpanists know how to maintain their instruments and tune them.

We certainly know that most piano owners and pianists need someone else to tune and maintain their piano. It almost makes me think of a music lover who needs a technician to fix his or her Hi-Fi. The reason seems the same—both require special training for proper service.

That was not always the case. No doubt, before Bach and Teleman, composers and musicians tuned their own instruments. (I would like to hear some of Bach's piano tunings). Later, however, pianos became more sophisticated, they sounded better, more volume was needed for larger concert halls. Instead of one string per hammer it became two and three, and the so-called "unison" came into being. More sophisticated actions were developed, and it became obvious that someone had to specialize in piano work, and the modern piano tuner-technician was born.

The need for frequent tuning didn't change—what changed was the practicality. The tuner-technician was not always there when needed, and, of course, there was cost involved. The average piano owner was no longer in a position to tune the piano every time it was needed. A compromise had to be found. It became "practical" to service pianos once, twice, three or four times a year.

With this new arrangement, we also entered a time of misunderstandings and myths. As we already know, climatic changes will put a piano out of tune quite fast. Suppose a piano is tuned. Everything sounds fine. Next day it is warm and rainy, the house heat goes off, it becomes humid in the room, and—the piano becomes badly out of tune. The customer complains to the technician that "the piano didn't stay in tune for longer than a day." The tuner-technician checks out the piano and indeed, it is rather bad. In the above scenario, all is pretty clear and most likely the tuner-technician will explain to the customer what had happened, might try to prevent problems in the future by suggesting to stabilize the climate around the piano, or whatever he or she feels is the right thing to do.

Now let's think of another possibility. Suppose the customer didn't call the original tuner-technician back, but called a different tuner-technician, who is only told that "the piano just doesn't stay in tune." There is a pretty good chance that our tuner will do what we all have been taught—check the tuning pins which we will assume are okay, and sooner or later, our tuner might use the traditional "card trick" and try to push a business card between the pinblock and the plate flange. If at one point poor fitting of the block can be found, there is a pretty good chance that this tuner-technician will come up with a diagnosis blaming "poor fitting of the pinblock" for tuning instability. This brings me to one of my favorite subjects.

Suppose that a pinblock fits so poorly that it touches the plate flange only every six inches. Do you believe that the block can move? I don't think so. Suppose I am wrong, and the block can move toward the plate. We would then have to assume that at one point or another it will "get there" and stop moving. If so, could this block ever move back? I don't believe that. Finally, let me go even further and say that I am convinced that no pinblock that is fastened with about twenty screws tightly to a (sandpaper-like) rough plate can move in either direction. If the piano in our example was sharp, we could easily verify the "climate theory" by drying out the room (or putting a heater under the piano). If the piano goes back to normal pitch (approximately), it certainly was not due to a poorly fitted pinblock.

At this point, it should be pointed out that in all the years that I did plenty of piano rebuilding, I have always made it my business to fit pinblocks as well as possible. Please don't tell people Ernie Juhn doesn't believe in fitting pinblocks!

A shocking opinion (some tuner-technicians will hate me for this): in many parts of the country (world), there are seasonal changes of climate. In those areas it is better to tune once a year than twice, because it will not require dramatic pitch changes and the piano will remain more stable. Of course, pianos should be tuned more than once a year. I urge my customers to tune at least three times a year.

Restoring Antique Pianos

News And Views From The Restoration Front

Edward E. Swenson
Ithaca College School of Music

Several exciting months have passed since my last article on the history of pitch. I have received an interesting letter from Henry Steinway in which he included Steinway's unofficial list of pitch levels for major orchestras in North America. Eight orchestras claim to tune at 440, two at 441 and nine at 442. Many European orchestras apparently tune at much higher pitch levels.

From New Jersey I received a petition on musical pitch from the Schiller Institute, an organization associated with Lyndon LaRouche, which is attempting to help singers avoid voice strain by lowering operatic pitch to A=432. This organization has sought and received support from some of the vocal world's most distinguished artists, including Elly Ameling, Carlo Bergonzi, Dietrich Fischer-Dieskau, Placido Domingo and Marilyn Horne, to mention just a few. It is possible that famous singers will soon begin to insist in their contracts for A=432 as the pitch standard for concert and rehearsal pianos, recording studio pianos and for opera pit orchestras. For more information about a low-pitch concert sponsored by the Schiller Institute, see Andrew Porter's article "Musical Events—Touching Pitch" in *The New Yorker* (May 1, 1989).

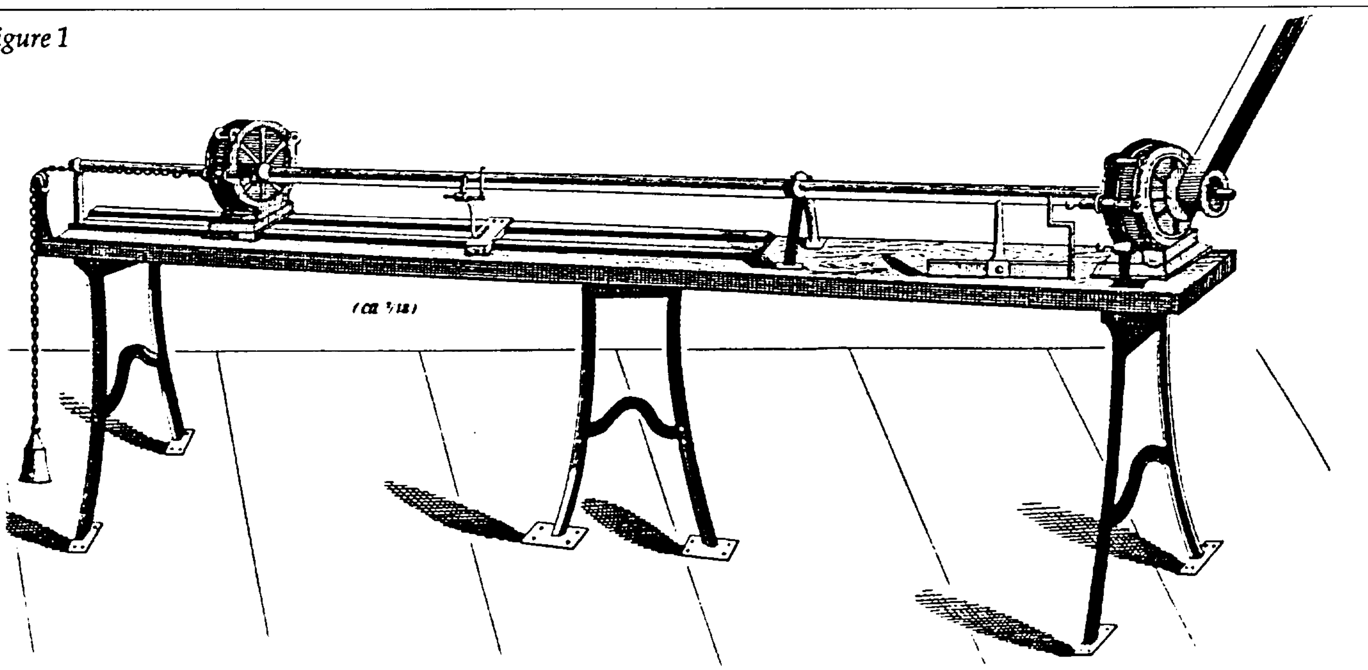
The first article which I wrote for the *Journal* in January, 1988, contained the names and addresses of some specific supply sources for piano restorers and some preliminary data on the strength and composition of antique music wire. I intend this article as a supplement. I have recently located a good source of supply for different types of leather. In many early pianos, leather was used for a variety of purposes, including making and covering hammers, key bushing and even as an understring material. A useful supply source for hard-to-match leather is:

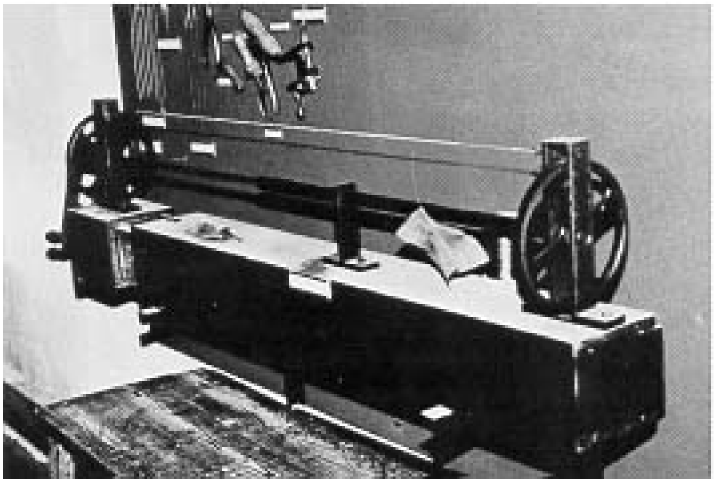
Friedrich Herzog Co.
Weberstrasse 11
D-8767 Worth am Main
West Germany

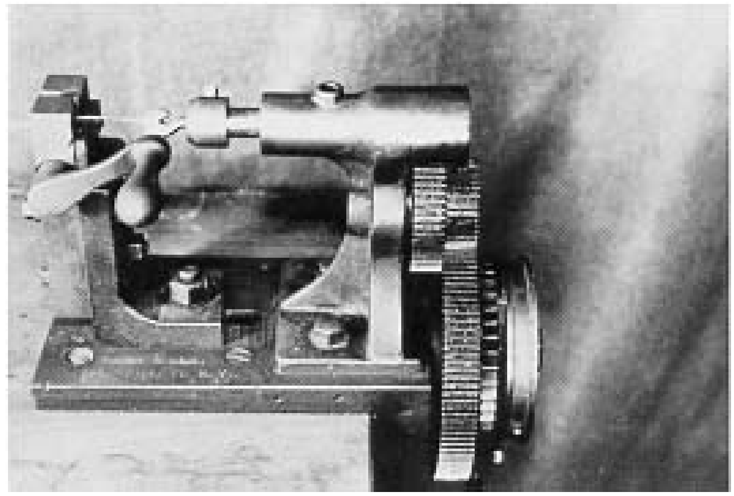
I have received numerous requests for information about replacement sources for the bass strings of early pianos. Finding suitable bass strings has also been a serious difficulty in my own work. In most cases I try to save the original strings, but in many antique instruments one finds the original bass strings are either partially or completely missing. It is a difficult task trying to convince bass string makers to use soft wire and materials other than copper for overspinning. Modern bass string manufacturers use high-speed string lathes which are not appropriate for work with soft 19th-century wire.

The bass and iron wires used are often not available from modern bass string makers. The lathes used to make bass strings in the past were considerably different, but not necessarily inferior to the machines of today, although it took much longer to wind each string. (Illustration 1 depicts a German, ratchet-operated, bass-string lathe from the middle of the 19th century. Illustration 2

Figure 1







2 3

shows some antique tools and a hand-cranked, bass-string lathe from a display at the Boesendorfer factory in Vienna.)

A few weeks ago I was fortunate to find two old bass-string lathes, which I hope to slow down and modify for making bass strings for antique pianos. At the same time, I obtained four Dolge hammer presses and several other interesting pieces of antique piano manufacturing machinery, including a hand-cranked wire looping machine. (illus. 3) All of the other looping machines I have seen are toys compared to this superb, 19th-century equipment. By mid-summer I hope to have this antique equipment set up for work.

The Roeslau Co. in Germany has generously donated time and effort to complete the following tests on fragments of antique music wire.

I have arranged the new test results chronologically along with the tests which were first published in the *Journal* in January, 1988. In addition, some small errors have been corrected. Tests 16 through 21 are from wires of modern manufacture, although the Malcolm Rose wire attempts to duplicate the characteristics of early 19th-century wire. Variations in diameter indicate that the wire is slightly out of round.

I was particularly interested in the test results for the wire from the 1863 Streicher piano in test 11. This wire has a tensile strength which is close to modern wire, although the carbon content of the wire is only about half of the modern standard, while the wire from the Wagner Bechstein, made a year later in 1864 (test 12), is quite similar to modern Roeslau wire in both tensile strength and carbon content.

Many piano technicians were partial to German wire made by Giese, before that company stopped supplying music wire a few years ago. The Giese wire (test 20) has a very high tensile strength and a correspondingly high carbon content. One wonders if the high tensile strength of the wire found in turn-of-the-century Steinways (tests 13 and 14) has anything to do with the high pitch (A=457) to which Steinways were apparently tuned during that period. There are many elements which affect the quality of music wire, including the polish of the wire and the speed at which the wire is manufactured. Modern wire is made as fast as possible with the wire passing through several diameter reductions in quick succession. In the 19th century the wire was allowed to rest after each drawing and more emphasis was placed on giving the wire a high polish, which helps protect it from rust.

From July 21 to July 26, 1989 the first international congress concerning the (forte) piano from the 18th to the 21st century will be held at Elzenveld (Antwerp), Belgium. The congress will feature concerts on historical and contemporary instruments, exhibitions of replica and original fortepianos and clavichords, workshops for makers and technicians, including a workshop on fortepiano regulation and voicing with the respected fortepiano maker, Christopher Clarke. The rationale for this congress is described as follows by its organizers: "There was a time when each nation enjoyed its own sound ideal and consequently its own piano. That is how it was until the beginning of this century. Thereafter, the situation changed: uniformity spread, and a piano became simply a piano.

"Then the wave of "early" music and "early" instruments appeared.

The most spectacular revival was that of the fortepiano. A piano is no longer just a piano: it can be the translucent Viennese instrument so loved by Mozart, or an English grand of 1820 upon which Field could sing, or a brilliant Erard of 1840, which so enraptured Liszt, or an American grand or a Pleyel of 1920, or a German Steinway of 1960, or a Tallone of 1970. Increasingly, more instrument makers feel attracted towards the other pianos, increasingly more pianists appreciate the wealth of divergent sonorities. In the meantime, more than one thousand recordings have appeared on the market and the great festivals are opening their doors to the (forte) piano."

The modern piano technician, particulary in urban and university settings, will have to learn about the idiosyncrasies of tuning, regulating and voicing both original instruments and replica fortepianos. Additional information about the congress can be obtained from: Antverpiano 1989, Centrum Elzenfeld, Lange Gasthuisstraat 33-39-45 B-2000 Antwerp, Belgium.

Chart Of Chronologically Arranged Wire Tests

Wire Sorces	*Diameter mm*	*Min. Load Cap. In N (Newtons)*	*Tensile Strength N/mm²*	*Carbon %*	*Sulfur %*
1. Graf fortepiano #1594 (Vienna, c. 1830)	.772/.777	560	1,189	.3150	.015
2. Graf #1594 2nd test	.911/.921	530/535	804/812	.095	.007
3. Graf #1594 3rd test	.754/.769	440/445	967/978	.125	.010
4. Graf fortepiano #2627 (Vienna, c1838)	.886/.885	530/540	882/898	.077	.008
5. Graf 2627 (Brass Wire)	.995/.940	610	830	—	—
6. Boesendorfer fortepiano #167 (Vienna, 1840)	.790/.802	580/590	1,170/1,190	.370	.045
7. B.G. Wire (Vienna, c. 1840)	.730/.735	400	950	.0553	.0044
8. Broadwood grand #15793 (London 1850)	.993/1.005	900/905	1,148/1,155	.45	.035
9. Chickering (Boston, c. 1850)	1.150/1.190	1,815/1,910	1,690/1,780	.72	.052
10. Boesendorfer #3881 (Vienna, 1851)	.810/.814	1,070	2,066	.72	.010
11. J.B. Streicher grand #6493 (Vienna, 1863)	.744/.749	890	2,036	.46	.008
12. Bechstein grand #981 (Berlin, 1864)	.945/0.947	1,610/1,640	2,291/2,333	.81	.017
13. Steinway (NY) #89867 (1897)	1.130/1.148	2,540/2,560	2,490/2,510	.740	.032
14. Steinway (NY) #160445 (1913)	.965/.969	1,860/1,925	2,530/2,620	.770	.034
15. Steinway (NY, 1959)	.938/.943	1,680/1,700	2,421/2,450	.74	.010
16. Malcolm Rose Type B	.693/.695	340/360	900/950	.120	.018
17. Malcolm Rose Type C	.893/.900	720	1,140	.450	.022
18. Malcolm Rose Type C (Control test)	.900	720	1,132	.4380	.0240
19. Christopher Clark, Cluny, France. Modern harpsichord wire	.921/.929	1,580	2,351	.805	.011
20. Giese Wire Co., sample wire c. 1975	1.119/1.125	2,410/2,380	2,437/2,407	.915	.0135
21. Roslau wire, sample wire c. 1987	.900	1,457	2,290	c. 0.85	?

About tests 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15: These test wires were fragments of old, original strings which had already been under tension.

Test wires 1, 2, & 3 are different original strings from the same Graf fortepiano.

About Test 7: "B.G." wire found in a drawer next to the keyboard of an early square piano built by Joseph Knamm in Vienna (c. 1840). This test result is interesting because the wire has never been under tension. The test shows that this iron wire has a very low carbon content and a correspondingly low tensile strength.

About Test 11: Original wire from a J. B. Streicher grand piano selected at the factory by Johannes Brahms for Amalie Bauer.

About Test 12: Original wire from a grand piano given by the Bechstein company to composer Richard Wagner.

The author thanks Dr. Hans Joachim Krueger of the Roeslau Stahl—und Drahtwerk for his help in preparing these test results.

Coming Events

July 10-14, 1989	**32nd Annual PTG Convention & Technical Institute** Red Lion Lloyd Center, Portland, OR Contact: Home Office, 4510 Belleview, St. 100, Kansas City, MO 64114 (816) 753-7747.
Sept. 23-24, 1989	**Milwaukee Chapter Days** Howard Johnson, 611 W. Wisconsin Avenue, Milwaukee, WI Contact: Rudolph Moroder, 3916 N. Frederick Ave., Shorewood, WI 53211 (414) 332-8474.
Sept. 23, 1989	**Rhode Island State One-Day Seminar** Providence, RI Contact: Robert Case, 24 Sunnyfield Dr., Westfield, MA 02790-4825 (508) 636-4691.
Oct. 1-3, 1989	**Florida State Conference & Seminar** Clarendon Plaza, 600 North Atlantic Avenue, Daytona Beach, FL 32018 Contact: Walter Pearson, 1128 State Avenue, Holly Hill, FL 32017-2728 (904) 255-4804.
Oct. 6-8, 1989	**Ohio State Conference** Holiday Inn North, Dayton Contact: Francis Hollingsworth, 2271 E. Spring Valley Paintersville Rd., Xenia, OH 45385 (513) 372-1981.
Oct. 13-15, 1989	**Texas State Association** Lubbock, TX Contact: Bob Johnson, 3224 92nd, Lubbock, TX 79423 (806) 792-9712.
Oct. 20-22, 1989	**New York State Conference** Queensbury Hotel, Glens Falls, NY Contact: Robert Reeves, RD #1, Galway Rd., Ballston Spa, NY 12020 (518) 885-5472.
Oct. 27-29, 1989	**North Carolina State Conference** Hyatt Winston-Salem Contact: John Foy, 195 Fayetteville St., Winston-Salem, NC 27107 (919) 773-1754.

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Southeast RTTs	393
South Central Region	319
South Central RTTs	213
Central East Region	620
Central East RTTs	407
Central West Region	392
Central West RTTs	284
Western Region	902
Western RTTs	620
Total Membership	3687
Total RTTs	2463

The Auxiliary Exchange

President's Message

Have you ever received a surprised expression or an incredulous "Really?" when you told someone of your spouse's profession or business? Did they take the news with frank amazement? Did they presume the craft of piano tuner/technician had gone the way of the wheelwright, the whaler, the weaver or the barge tender? In this era of electronic keyboards, CDs, large sized TV screens, VCRs and such many assume that pianos—wherever they exist—never need any unique care or attention, just a weekly dusting and perhaps someone to fix a stuck key. Those not exposed to the technician's profession do not realize that the piano, the single "big ticket" item in the home that is rarely turned in for a new model like the automobile, needs to be tuned, regulated, voiced, perhaps recapped, humidifiers installed and, in general, cared for and properly maintained. Some people realize this; others do not.

Our casual inquirer would be further surprised to learn, for instance, that at our annual convention in St. Louis in 1988 there were 681 Guild members in attendance and 182 non-members. About a third of our Auxiliary membership was present—101, in addition to 44 non-Auxiliary members. We can be proud of these statistics and this "specialization" in view of the glut of attorneys, fast-food purveyors, and computer programers, while there is a dearth of nurses, plumbers, school teachers and foster parents.

It is important for each of us to have a general overall knowledge of the art of piano technology, in order to appreciate the work achieved by our spouses. An easy cliche one might remember is that the piano is the only instrument that the artist does not tune. The cellist, the violinist, the saxophonist all tune their own instrument to the "A" they get from the oboeist, but the pianist must rely on the piano tuner/technician to properly tune this complex instrument. We are fairly certain that at a live performance or over a TV channel you have seen Itzhak Perlman tune his violin at the start of or between orchestral numbers. However, Vladimir Ashkenazy, one of the finest pianists of the post-1950 generation had his Steinway or Bosendorfer or Yamaha tuned earlier by a piano/technician!

Be proud of your technician/spouse. Learn about his/her profession through the Auxiliary business and general information classes.

Agnes Huether, Editor

Bombyx Mori

Top designers, couturiers, textile merchants and some fashion conscious buyers may recognize the above title. Perhaps readers who were biology majors in college and our coterie of Auxiliary members who are skilled with the sewing needle may be aware of the scientific name. But for the rest of us, bombyx mori is the scientific name for that fascinating caterpillar who requires infinite care and painstaking attention to eventually emerge as the much sought after silkworm.

The New York Times fashion reporter recounts that washed or sueded, silk is today competing with cotton and linen as a uniform for spring and summer. After World War II, Henry Lehr, a fabric designer, came upon a silk broadcloth parachute. He washed it after every jump and noted it had taken on the feel of chamois. In 1981 he took the old parachute to Jerry Hirsch who owns L'Zinger International and as the saying goes, " the rest is history." Today sportswear as well as formal attire, jackets, blazers, jump suits and trench coats are made of washed silk. Even bed sheets may be bought for a mere $1,000.

According to experts at the Fashion Institute of Technology in New York City, washed silk grew out of the fad for dressed leather and stone-washed denim. This finishing was done in Hong Kong and India. The process involves a wash with sand, rope, pumice stones, or pebbles. The fibers dry quickly and the textile resists wrinkles. Silk is in; sales are phenomenal...but now to the source.

The history of silk dates from about 2600 B.C. under the reign of Hoang-Ti the then emperor of China. The cultivation and harvesting of silk from the bombyx mori was a closely guarded secret for over 2,000 years. About 600 B.C. the Chinese traded some silk textiles to the Persians and they in turn carried silk to the Western nations. All raw silk was imported from China up until the sixth century A.D. and the export of silkworm eggs from that country was forbidden on pain of death. The jealousy guarded secret of silk cultivation or sericulture was disclosed through bribes when the Emperor Justinian succeeded in obtaining a quantity of silkworm eggs. This was the beginning in Europe of an industry which soon spread rapidly over the Mediterranean countries reaching France in the 17th century. Silk culture in the United States began in Virginia in 1622 with fair results, but on the whole was unsuccessful. Laces, dress silks and tapestry had a modest production in New Jersey up until the development of nylon and related textiles by the DuPont Company in Wilmington, Delaware. Prior to DuPont's innovation, Paterson, N.J. had the title of "Silk City."

The bombyx is the cultivated silkworm. From the cool, segmented, pulsating body of the silkworm comes the most coveted and luxurious fiber. Harvested for over 2,000 years, the fiber is lighter yet stronger than steel, pound for pound! It has been used to make ship sails, parachutes, fly-fishing lines and tires for racing bicycles! Silk is also the substance in surgical sutures and artificial arteries used in surgical transplants in China. Silk can also be found in parts for high-powered optical equipment. Its uses are vast.

Raising silkworms is a serious business. Silkworms need 6 to 8 feedings a day of fresh mulberry leaves. Sericulture can be a "cottage industry;" it is in Japan, but it demands fastidious care. There can be no loud noises or foul odors, and temperature and humidity must be constant. Cleanliness is of the utmost importance. Any infraction of the foregoing could lead to disease and the death of thousands of silkworms in one day!

The mulberry leaves, washed and free of chemical sprays and exhaust fumes, must be fresh and must be re-placed every few hours or the silk worm will stop eating. The mulberry leaves resemble hydrangea bush leaves and the silkworm looks not unlike a raw shrimp.

Silk is a protein fiber that differs greatly from other animal fibers such as wool, mohair, cashmere or human hair because it is not a growing cellular fiber, but an extruded fiber. Wool and many other fibers can *felt*, while silk does not.

The best silk is produced by a monovoltine caterpillar which completes one life cycle a year. The eggs require the remainder of the year to incubate and hibernate. People havé discovered, however, that treating the eggs with hydrochloric acid tricks them into feeling that they have completed their hibernation period. Treated eggs require only a 14-21 day rest before they hatch again, so polyvoltine caterpillars can produce as many as six to eight crops a year. Their cocoons, however, are smaller and lower in quality than those produced by the monovoltine caterpillar.

When this writer discovered that the silkworms were being pressed to over produce, she was reminded of the chicken farms that operate with lights on all through the night to increase chicken egg-laying production. (Why must we meddle with Mother Nature?)

When the silkworm eggs hatch into larva, the caterpillar feeds voraciously for a month to six weeks on the mulberry leaves and grows rapidly until it measures about three inches in length. It sheds its skin four times, the molting periods characterized by no feeding but rather a condition of torpor or inactivity.

After the forth molt, the worm attaches itself to a twig, and begins to spin its cocoon from a glutinous secretion contained in two tubular glands, one on each side of its body. Out of two openings in its head called "spinnerests" proceed two slender filaments of this glutinous substance. These stick side by side and form a flat thread, which the silkworm, by turning its head from side to side, folds around its body, until it is completely embedded in the silky covering; this usually takes about three days, after which the insect rests in a pupa state. When unmolested, it is ready to emerge in two or three weeks, and bore its way out at the end of the cocoon, to appear as a small ashy-white, feeble moth. The silk cocoon is one continuous mile-long filament that must be kept intact for processing. The transforming chrysalis inside the cocoon must be stifled (nice word?) before it becomes a moth.

If the moth appears, mating takes place at once, the eggs are laid, and within a week the cycle of life is complete. This is the natural course of events, but since the exit of the moth from the cocoon cuts the silken fibers, the silk grower allows only as many insects to emerge as may be necessary to produce eggs for next years crop.

This writer is indebted to the Newark Museum and the *New York Times* of 5/21/89.

Sally MacGundy

The Good(?) Old Days

It was fifty years ago on March 3rd that Lothrop Withington Jr., a Harvard College undergraduate won a ten dollar bet (sic) by swallowing a live goldfish in the college union. He engaged in this feat to show his fellow classmates what he had witnessed on a Honolulu beach several years before. Withington's stunt caught a good deal of publicity and inspired a mania for goldfish swallowing that emptied aquariums across the United States.

Not to be outdone by a Harvard man, and to fan interest in youthful exploits, students tried to swallow more and more goldfish at a sitting. The enthusiasm and the surge of competition finally dwindled when a student was suspended from his classes at Kutztown State Teachers College in Reading, Pennsylvania for swallowing a record forty-three goldfish! The stakes seemed to have gone too high. About a month later the craze had burned itself out and a new mania took over. Students started eating magazines at Lafayette College and 78-rpm records at the University of Chicago!

Back in 1939 Katherine Hepburn, who had been labeled "box-office poison" in Hollywood, opened on Broadway in Manhattan in *The Philadelphia Story* to rave reviews. The show ran for 417 performances and according to Miss Hepburn, "I made more money doing the *Philadelphia Story* as a play than in my whole time in Hollywood." Hepburn's performance in the 1940 film adaptation of the play returned her to the first rank of Hollywood stars.

It was 25 years, ago, March 4, 1964, that President Lyndon Johnson appointed ten women to government posts in a move designed to end "stag government." His major appointee, Katherine E. White, became the U.S. ambassador to Denmark. The President told his audience at the Women's National Press Club dinner, "I am unabashedly in favor of women."

Inez Elizalde

"I Think I Can..." Conclusion

The conclusion of Judy White's article "I Think I Can..." was inadvertently left out of the June 1989 PTG Journal. Following is the segment of the article that is missing in the June issue.

Bolstering our self-esteem and self-respect by listing our personal assets is a first step to directing our mental energies in a positive way. This good mental energy can then be harnessed to establish the new you and decisions you make.

Each year my husband and I have said, "I think I can attend convention." We have many reasons for not attending (namely two children in college) but we've made our goal each year because of positive thinking and planning and when we get home we say, "I'm glad we could."

Even though you may not travel with the *Little Engine* to Portland, maybe it will give you some food for thought in days ahead when your goals seem illusive. Childhood stories can entertain as well as teach even when we are adults!

I think you can, I think you can, I think you can...I knew you could.

Judy R. White, Corresponding Secretary

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Congratulations To Beverly Shaffer From The Piano Technicians Guild Foundation

Beverly, a Montgomery, AL, piano teacher, received a $500 Piano Technicians Guild Foundation scholarship for continuing education during the Music Teachers National Association Annual Convention in Wichita, KS, April 1-6. She will use the scholarship for advanced study with Steven Hall in Atlanta, GA.

A recipient of Bachelor and Master of Music degrees in Piano Performance from George Peabody College, Beverly is now adjunct faculty at Auburn University and Huntingdon College, and maintains a private studio in which she teaches both piano and Kindermusik. She is a nationally certified member of MTNA.

* * *

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