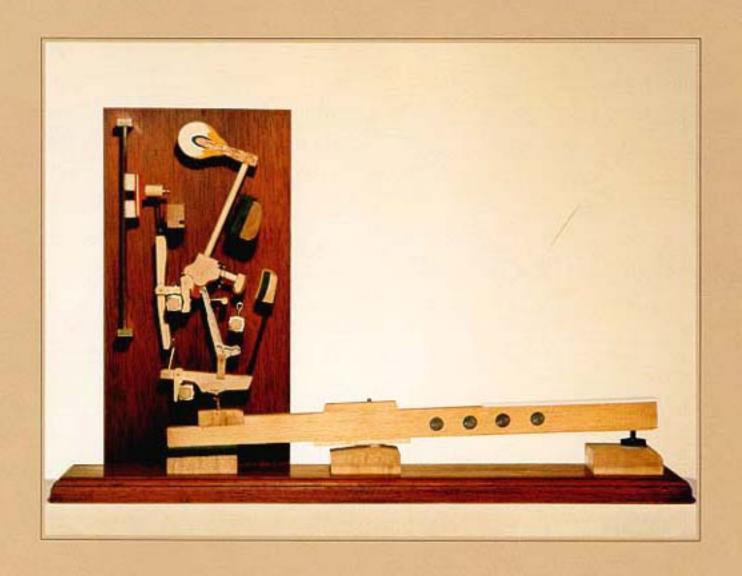
PIANO TECHNICIANS OUTNA FEBRUARY 1989



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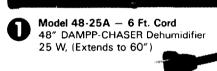
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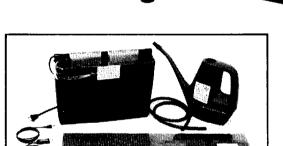
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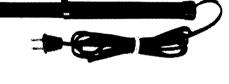
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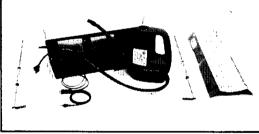




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PIANO TECHNICIANS

FEBRUARY 1989 — VOLUME 32, NUMBER 2

OFFICIAL PUBLICATION OF THE PIANO TECHNICIANS GUILD, INC.

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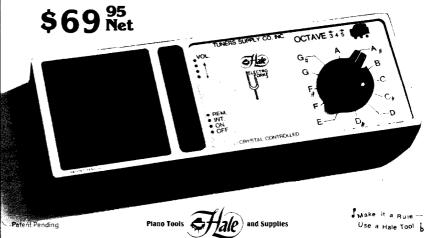
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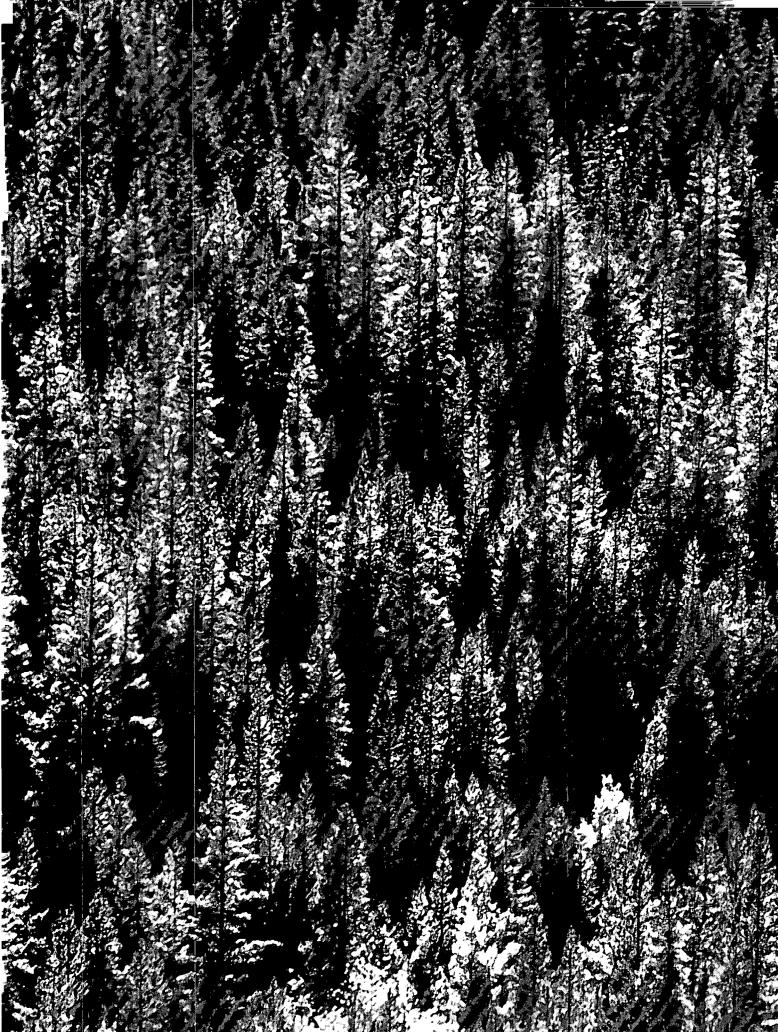
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President's Message

What Is The Home Office?

The beginning of a new year marks other new beginnings. January 1 marked a new beginning for PTG. As of January 1, 1989, PTG is managed by our own staff rather than by staff at a management company. Larry Goldsmith, Mary Kinman, and Sandy Essary, who have been working for us full time at Martin Fromm & Associates, are now hired by us directly along with two others new to PTG. Gayle Sorensen is our receptionist and assistant Journal editor, and Cyndi Wright is our accounting and convention coordinator.

What does the Home Office do and why do we need it? Probably the most obvious thing that comes from the Home

Office is the *Journal*. Home Office staff handles advertisers—both finding new ones and servicing the existing ones. While much of the *Journal* is written by our technical editors and other members, much of the other text is written by Home Office staff. Industry reports, organizational news, the *Update*, etc. are written mainly by the Editor and staff.

Membership records are another big responsibility for the Home Office. Keeping accurate records is important to assure that you get your *Journal*, insurance, membership cards, directory listing, convention mailings, and other services. With the member list of 3,500 and a nonmember list of about 8,000, maintaining these records is a large job. Membership information such as addresses, membership classifications, etc. change daily and handling it often involves several followup phone calls. From the membership records, the dues bills are printed. Dues collection and follow up is another large job because it all



Ronald L. Berry, RTT President

happens during a very short period of time.

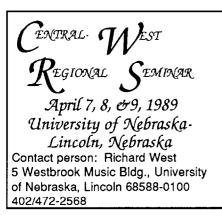
Other communications that come from the Home Office are convention promotions, press releases to the media, the monthly chapter mailings, the weekly Board mailings, and numerous personal letters to new members, reclassifying members, and the surviving family of members who have died.

Accounting and financial records are another important function involving income from dues, sale of merchandise, convention, interest on investments, etc. Tracking expenses and producing an annual budget are critical tasks. Because

most income comes from dues at the beginning of the year, the accounting department makes appropriate investments to get the maximum return on money until it is needed for operating expense later in the year.

For the convention, there are hundreds of details from negotiating the hotel contracts, to planning meal function menus, to selling exhibit space, to preparing Council agenda books. There is work to do on the convention throughout the year although the biggest crunch is just before and during the convention itself.

There are certainly many other functions the Home Office performs but this gives you some idea of the main ones. PTG has reached the size and activity level to make it more practical to hire staff directly in a "captive staff" arrangement. Because three of the people are people who are already experienced with our operation, it should be a rather easy transition.



CLASSES

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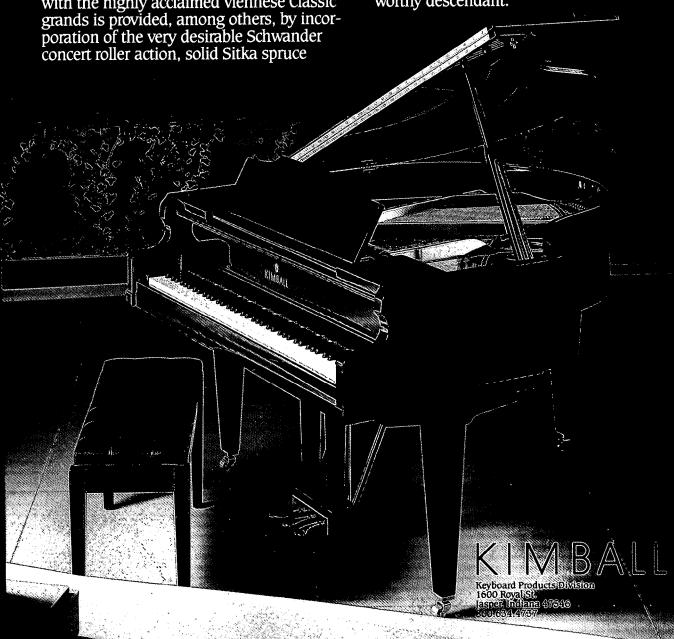
its proud pedigree.

Evidence that the new 5'2" grand continues those quality attributes associated with the highly acclaimed Viennese Classic grands is provided, among others, by incor-

soundboard and heavier professional quality hammers. These beautiful new pianos are offered in five popular wood finishes.

The new Kimball 5'2" grand now takes its rightful place at the side of its forebearers representing the finest in piano architecture, state-of-the-art engineering and production craftsmanship.

The 5'2" Viennese Classic grand . . . a worthy descendant.



the newest Viennese Classic at Winter NAMM. Booth 6040

From The Home Office

Changes

I f you've called the Home Office lately, you may have noticed that the friendly voice on the other end of the phone said "Piano Technicians Guild" instead of "Association Headquarters."

That may seem to be a little thing, but it is indicative of much larger changes in the way the Guild operates. After 10 years of being headquartered in the offices of association management companies, first in Seattle and then in Kansas City, the Guild has established its own Home Office. The decision to establish a separate office with the Guild's name on the front door was made by the Board of Directors in July (see President Berry's message on page six).

In the past five years, the Guild has come a long way. It now is in an improved financial position, with successful, well-run conventions, informative publications and a lengthening list of member services. There is much, however, that still remains to be done: consolidating the gains of the past few years, providing better service to members, compiling information about our corner of the industry, and bringing knowledge to those who may not know that it is available. A new Home Office structure designed specifically for the Guild should

Our new
address is: The
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Larry Goldsmith Executive Director

help us to better meet those needs.

Our new address is: The Piano Technicians Guild, Inc.; 4510 Belleview, Suite 100; Kansas City, MO 64111. You can call us at (816) 753-7747. I hope you will do so proudly, knowing that this office belongs to you and the other members of the Piano Technicians Guild.

You probably also noticed a few changes in the look of this month's *Journal*. Most publications are redesigned every few years to keep them fresh and appealing to members. That's part of the reason for these changes. We're also taking advantage of new technology which has become available in the past few years Our new computer system, in addition to

keeping track of member records, managing our accounting procedures, writing letters and other office functions, will allow us to produce the type, artwork and layouts internally, thereby giving us more control of production and scheduling at, hopefully, a lower cost.

I hope you like the new look of the *Journal*, and I'm eager to hear your comments. **■**





FOLLOW THE OREGON TRAIL

The 1989 Technical Institute

One of the features of the 1989 Technical Institute will be classes by Darrell Fandrich and Chris Trivelas on the Fandrich vertical action. They will discuss the differences between grand and vertical actions, the limitations of current vertical actions, and introduce their new, im-

proved action in a working piano. You will not want to miss these demonstrations. Articles concerning this action are being presented in current issues of the *Journal*, but you owe it to yourself to see this action in a piano and have "hands on" experience with it. It is a very exciting development.

Companion classes will be taught in vertical care and

Ben McKlveen 1989 Institute Director repair, from the old uprights—those that are worth the trouble and expense—on up to through classes on all phases of vertical part replacement and regulation. More about these and other exciting classes will be presented later.

If you are a Guild member, you can learn effective ways to give the Guild tests. If you want to become a Guild member, there will be wonderful opportunities to learn how to take the tests effectively. You cannot afford to miss this educational experience.

Plan now to "follow the Oregon trail" to Portland for the 1989 Convention and Technical Institute. ■

Portland: An Alive And Vibrant City

Portland is not a big city. Some say that's part of its appeal. Its population of 375,000 is surrounded by a metropolitan area which includes Vancouver, WA, on the north. This gives us a total population of 1.2 million

souls. And, although Portland is not a huge city, we believe you'll find everything you're looking for in a convention city. Let's go on a short tour of the city core.

The City of Portland is effectively divided by the Willamette River. The 1989 Annual Convention Hotel, the Red Lion Lloyd Center, is on the east side of the river. To the north of the hotel is the Lloyd Center, one of Portland's many shopping centers. There are lots of restaurants, fast food places, etc. for you to take advantage of close to the hotel. On the south side of the hotel block is the MAX light rail line. This is the pride and joy of the Tri-Met Transportation System in the Portland area, and MAX will take you the dozen or so blocks to and across the Willamette

River into the downtown shopping area.

Downtown Portland is not one of those cities that's slowly dying on its feet. It is an alive and vibrant city with ten parks as well as eight fountains to visit and many,

Taylor Mackinnon Portland Chapter Liaison



Portlandia

many retail stores, department stores, etc. A walk along the river front from the Burnside Bridge to River Place will show you how important clean waterways are to Oregonians. The Saturday Market, which is really open

Saturday and Sunday, operates from under the Burnside Bridge. It features all kinds of arts and crafts as well as a myriad of food booths. Further south is the Tom McCall Waterfront Park and the sea wall where the Navy fleets tie up during Rose Festival in June. The height of the river is affected by the tide of the Pacific even though it's 80 miles down stream. At the point where Salmon St. dead ends at the river is Portland's newest fountain. There are many fountains within walking distance of the river front. One, Ira's Fountains, is west across the street from the Civic Auditorium. This fountain is actually a large sculpture of falling water and pools. Visitors are invited to take off their shoes and wade in the pools or walk back behind the cascading waters.

Also downtown is "Portlan-

dia," said to be one of America's five significant public sculptures in the last half-century. It is the largest ham-Continued on next page

INDUSTRY NEWS

Camilleri to Represent Renner in the U.S.

Camilleri Pianoworks, Ltd. of New York City has become the sole agent for Renner products in the United States. The agreement was announced by Robert Lins, Managing Director of Louis Renner GmbH & Co.

Under the agreement, Camilleri will assume responsibility for the marketing, distribution, technical support, and product direction for Renner products sold to piano technicians and distributors. Renner will continue to supply manufacturers of new pianos direct from Renner's factory in Stuttgart, West Germany.

Camilleri currently restores over 250 grand pianos a year from its factory in Manhattan. Camilleri was acquired in 1986 from its founder by Lloyd Meyer and Robert Philbin. Meyer, a 25-year industry veteran and former President of Steinway and Sons, is a past president of the Piano Manufacturers Association International, the National Piano Foundation, and a former Director of the

American Music Conference. Philbin was plant superintendent at Steinway & Sons for 16 years and managed all upright and grand production. In 1980, he left to become president of Fairfield Piano Company, a major rebuilding operation in New York and Connecticut. He has also served as a consultant to the Chinese piano industry.

Judge Dismisses Suit Against Steinway

In a Nov. 10 ruling in Chicago, U. S. District Judge William T. Hart dismissed an antitrust lawsuit against Steinway & Sons by the company's former Chicago area dealer, Hendricks Music Co., Inc.

Hendricks had brought the suit in an attempt to block Steinway from terminating its dealership for its refusal to abide by a contractual provision requiring it to promote only Steinway pianos in concert and artist activities. Hendricks had signed on to handle Yamaha's concert and artist program.

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Portland...

mered copper sculpture erected since the Statue of Liberty. There are also several museums and art galleries to take advantage of. But mostly, there's the wonder of being in one of the cleanest cities you'll ever visit. The air is clean, the water is clean, the streets are clean. I can hardly wait to show off our city to you! I know you'll love it.

Next month I want to share Washington Park with you and a few of the other easily accessible sights. Get into a "carnival mood;" make reservations now to be at the Red Lion Lloyd Center in July. The City of Roses is waiting for you.

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THE TECHNICAL FORUM

Grand Lyre Repair

Susan Graham Technical Editor

have been receiving a lot of interesting mail: newsletters, questions, tips and articles. It's greatly appreciated keep up the good work! A lot of it is quite extensive: this month we have two excellent long articles. One is the continuation of the Fandrich/Trivelas article on vertical actions. The other is the first of a series which I am most pleased to be able to offer. It comes from Fern Henry and Bill Spurlock, who have already been so involved and given so much to this organization it is difficult to believe they have time to do more. Theirs will be a series on basic piano craft: typical service problems we encounter and need to solve efficiently and well. I can think of no better topic, and no more clear-headed and experienced a pair of technicians to write it.

Grand Lyre Repair

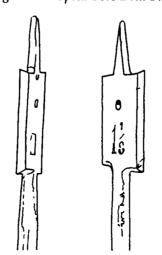
To further explore piano service which requires crawling around on the floor (started in December with grand leg repairs), I will discuss a few solutions for common grand lyre problems.

The attachment of a lyre to a piano can be as troublesome and mysterious as the fastening for the legs. It is often similar: a two-piece cast iron plate and a latch to hold the two locked together. Lyre plates occasionally break, but if the braces are intact and properly installed, it is not common. The problem which seems to occur most often is on less expensive pianos: the lyre is installed simply by screwing it into the keybed. The screws strip out and the lyre becomes unstable and noisy. Although it is possible to plug and redrill the holes, installing tee-nuts into the keybed and attaching the lyre with the appropriate 12 — FEBRUARY 1989 PIANO TECHNICIANS JOURNAL bolts yields a longer-lasting and more solid result.

This is almost as simple as it sounds. The tricky part is that the head of the tee-nut must not protrude above the level of the keybed or it will interfere with the keyframe. Due to the slight inconvenience of a pinblock in the way, it isn't possible to drill or rout a recess into the keybed from above. Our invaluable Isaac Sadigursky has found a solution with a simple modification of an Irwin speed-bore bit so it can be used for this particular piece of woodworking.

I started with a 1 1/8" bit. Slightly larger than the head diameter of any teenut I've encountered, this allows for less-than-perfect alignment (the bit does chatter a little in use). The modification is made to the shank end of the head; the conventional cutting surface remains intact and can be used in the standard manner. Slightly-over-an-inch is often a useful size, so this ends up being a handy

Figure 1 — Speed Bore Drill Bit



dual-function bit.

The bit is ground to form a cutting edge on the lower surface of the head (nearest the round shank portion, opposite the standard cutting edge). This is done on a fairly fine grinding wheel and finished with a file. Cool the bit frequently (by dipping in water) during grinding. It takes a minute to figure the direction the bit will rotate and the appropriate angle for the new cutting surfaces: the end result is, in profile, a trapezoid (fig. 1). Viewed straight on, the edge should be square to the shank.

Before installing the tee-nut, the existing hole for the lyre screw usually needs to be drilled out to accommodate the exterior diameter of barrel of the nut. Then, drop the shank of the modified speed-bore into this hole through the keybed and chuck it into the drill (fig. 2). While the drill is running, the tool is lowered until it contacts the keybed, routing a shallow circle. Repeat the process for the other screwhole. Drop the tee-nuts into place but do not tap them down to seat the spurs. Instead, put the lyre in position under the piano and run bolts up through it into the keybed and thread the tee-nuts onto them. This allows you to use the bolt to pull the nut down so it aligns itself and seats properly (fig. 3). (There is some play in the hole and it is possible to get the nut misaligned just enough to make threading the bolts quite frustrating). Bolt length must be calculated; it does no good to take care to keep the tee-nut from protruding and then have the bolt sticking up into the keyframe. The bolt should be the perfect length to pass through the lyre and keybed and thread

securely into the tee-nut without protruding into the action cavity. It may be helpful to use longer bolts to reach through the keybed to engage the teenut initially and pull it into position, and install the shorter bolts. I use machine screws when I can-usually a 1/4" or 5/16" (whichever corresponds to the largest size tee-nut the hardware store happens to have that day). If it is necessary to use a bolt which is not slotted for a screwdriver, I cut a slot with a hacksaw (for the sake of future technicians and/or piano movers who may not be equipped with wrenches or sockets). A washer should be used between the head of the bolt and the lyre; more than one can be used to keep the bolt from protruding into the keybed for those applications where one length bolt is slightly too short and the next size up is slightly too long.

There are simpler metal inserts, barrel-shaped without the flanged head of a tee-nut. These are easier to install, since they can be driven into a hole from either side. However, they are trouble-some, being inclined to lose the friction between the barrel and the wood and then rotate as the screw is turned. They are also difficult to align. Although it is slightly more trouble, a tee-nut yields a better result.

Once the lyre is firmly fastened to the keybed, it is absolutely necessary that the braces which support it are properly adjusted. Otherwise, it is a small matter for a pianist to kick the lyre loose again through normal playing (a small child can do it in a matter of weeks). Adjusting conventional wooden braces may require attention to either the pedal box or the keybed end (or both). Test the brace tightness by hand. First, attempt to move them lengthwise to detect any end play; there should be none. Next, try to rotate them: it should be possible to turn the brace. Obviously, this test works best on round lyre braces but even square-ended ones usually allow a slight rotation. These two parameters demonstrate if the braces are snug enough to support the lyre, but not so tightly jammed in place they are misaligning the lyre and in danger of breaking.

Many manufacturers now use metal lyre braces which are screwed into both the keybed and the pedal box. Unfortunately, it is more difficult to

Figure 2 — Drill Bit In Place In Keyboard

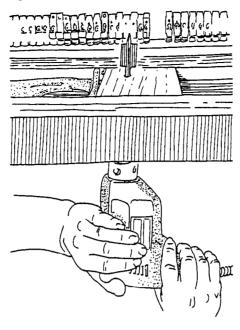


Figure 3 — Tee-Nut In Recess

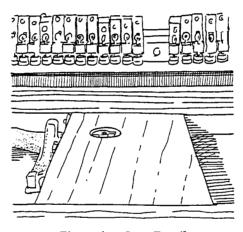
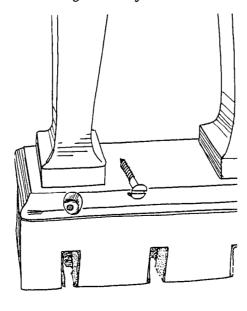


Figure 4 — Lyre Detail



Illustrations By Valerie Winemiller

detect fit with these, since the screws will hold the brace immobile even if it is not really correctly positioned, and adjustment may be difficult without plugging and redrilling a number of screw holes (shimming between the brace and the wood sometimes can be effective). These metal braces will occasionally hum, vibrating slightly in the hinge between the supporting rod and the plate which is screwed to the wood. A small wedge of hammer skiving will stop this elusive noise.

Adjustment of the conventional wooden braces is made at the contact point in the pedal box. Leather punchings can be added or subtracted. Another method is to insert a flat-head screw into the hole in the pedal box (fig. 4). The hole must be drilled and countersunk so the head of the screw can be turned all the way down flush with the wood if necessary.

Once installed, these screws can be adjusted to achieve the correct fit of brace (there should be a thin leather punching glued to the brace end which contacts the screw).

If the brace recess in the keybed is badly worn, no amount of adjustment at the pedal box will create an effective fit. The brace is too free to wander around the enlarged recess and is often noisy as well as ineffective. This can be solved either by chiseling out the damaged area and fitting in a piece of hardwood, or by adding small blocks, appropriately cut to accommodate the brace and positioned to hold it firmly (fig. 5). Scraps of pinblock material are excellent for making these blocks. On some pianos the brace recess is very near the edge of the underside of the keybed, and some ingenuity will be required to create a shape which can be fastened firmly in the correct location.

Then there is the phenomenon of the grand piano which constantly loses its pedal adjustment; even though the lyre is firmly fastened, every time you go out to tune there seems to be a great deal of lost motion in the system. You take it up and take it up until finally one day a large section of the lyre simply falls off. Usually by this time it will have become apparent that the lyre is coming unglued. Either the top crossbar or the pedal box, or both, have delaminated from the vertical posts and with each use of the pedal the whole thing is slowly

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sinking into the carpet. Jamming a book under the pedal box is effective but hardly high class. Proper repair requires that the lyre be disassembled so the old glue can be cleaned off, the posts resawed to accommodate new wedges, and the assembly reglued and rewedged.

Here again there are pitfalls. Frequently the lyre posts become unglued but are still jammed in position tightly enough to make diassembly difficult. One solution is to reverse a pipe clamp so it can be used to force the lyre apart, rather than pull it together (fig. 6). There are clamps made specifically for this purpose (to push out rather than pull in), but a pipe clamp or two is something most of us have around anyway. It is quick and cheap just to remove the screw mechanism, slide off the holding end, reverse and reinstall it, and screw the screw mechanism back on, also reversed. If only one post is loose and the other is still tight, it may be helpful to use another clamp (in a conventional fashion) to restrict the movement of the loose side and help keep the top bar (or pedal box) from coming off unevenly and getting jammed or doing damage to the wood. (It is counterproductive to break off the top of the posts.) The older the lyre, the more gently it needs to be treated; it may be advisable to apply heat, methanol or diluted acetic acid to the glue joints to soften them. Once the lyre has been reglued and clamped, drive wedges into the tops of the posts (fig. 7).

We will get more extensively into pedal and pedal box problems in the future, but there are a few more considerations for the lyre itself. One is the

Figure 5 — Lyre Brace Supports

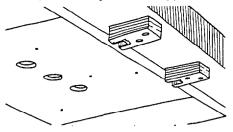


Figure 6 — Busting A Lyre (Reversed Pipe Clamp)

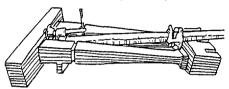
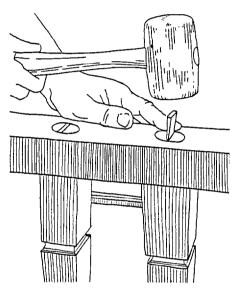


Figure 7 — Wedging Lyre Posts



very bottom piece of the pedal box, which often supports the pedals. It is critical

that this piece be intact and tightly screwed in place. This is particularly important in the dowel-mount pedal systems (such as Baldwin), in which the ends of the dowels which hold the pedals rest directly on this bottom board and will groan or squeak as well as not hold regulation if there is any play or looseness in the contact. Whenever you disassemble such a system, save yourself a lot of headache by keeping the screws in order, and by numbering the dowels and the corresponding holes in the pedal box. Any felt or cardboard shims under the dowels should be saved for reinstallation. As the screws holding this board are reinstalled, be sure each is secure; shim the holes, plug and redrill, or install a larger screw if necessary.

A source of noise and friction in a lyre is the rod guide. If the bushings are worn or hardened, they should be replaced. If the wooden piece itself is thin or lightweight, it may actually resonate, creating a very elusive groan. It is fairly simple to make a more substantial replacement. Rod guide holes are sometimes carelessly drilled and the alignment of the top of the rod to the trapwork may be precarious. Such guide holes can be plugged and moved to a better location.

Grand leg and lyre repairs call for conscientious woodworking. Both areas are subject to stress and heavy use; repairs must be thorough to achieve an effective and long result. There is something very satisfying about resurrecting a decrepit lyre and pedal system, however, and both casual and serious pianists are most appreciative.

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TUNING UP

Letters

Rick Baldassin Tuning Editor

W ith the last several months being devoted to the article on inharmonicity, the mail has really stacked up. This month, I will attempt to answer some of the questions which have come in, print reader responses to previous articles, as well as publish a new work by one of our colleagues.

Our first letter comes from Ward Guthrie, of Bozeman, Montana. Ward writes:

You have encouraged letters, so here are three things I have been curious about concerning tuning.

First, when I set a temperament, I primarily use 4ths and 5ths and extensively check with any 3rds and 6ths I can find. One needs to start someplace, and then as more checks are made possible, any or all notes done previously may need to be changed to make everything workout with the best compromise. What I would like to know is if my approach makes some correct assumptions as a starting point.

I first tune A-49 to my fork and check it with the F 17th below. Next I tune the octave A-37 and check with the 3rd-10th. These two steps are standard. The next two notes are my question.

The third note tuned is D-42. I read in some past article that the upper 5th should beat at the same rate as the lower 4th, in this case being about one beat per second (easily approximated with a watch), but the 4th should not be slower than the 5th. Then I check the 4th with the 3rd-6th test, and the 5th with the 6th-10th test. If the D is accurate, it clearly sets up the beats for all 4ths and 5ths in the temperament if the octave is set correctly.

The fourth note tuned is E-44. Again, as has been stated in articles, the rate of the parallel 4ths increases, but essentially all 4ths in the temperament are the same rate because that increase is negligible. So E-44 is

tuned to A-49 to beat at the same rate (but not slower) as the A-D 4th below. Again I make the checks on the new 4th and 5th.

These 4 notes thus set the rate for the parallel 4ths (all approximately the same), and set the limits for the 5ths (with the bottom one being about half the rate of the upper and the others progressing evenly between). Are these accurate placements before the 3rds are developed in the next steps?

My next question concerns parallel 5ths in the temperament. After the temperament is tuned, I compare parallel 5ths by keying my hearing on the 6:4 partials. They are faster, and thus easier to hear the slowly increasing speed of the 5ths. What I find on some small, inexpensive pianos is that this 6:4 partial must suddenly slow down when the lower note becomes a wound string in order for the other parallel and contiguous intervals to work out. What causes this, or am I doing something wrong?

Finally, I am sure all of us often get requests to pull the treble much sharper than it should be. How do you handle this with a customer? And related to that, the tuning exam demands clean single octaves in the treble, but is that what we should use on a

It does not matter to me how a person achieves their tuning, as long as the final result sounds good. Whether certain procedures have a sound theoretical basis, or logic behind them is another matter entirely.

home grand and/or concert grand? How does one make the decision as to what is best for the treble for that particular situation?

Thanks Rick. You do a great job with your articles.

I have stated several times in the past that it does not matter to me how a person achieves their tuning, as long as the final result sounds good. Whether certain procedures have a sound theoretical basis, or logic behind them is another matter entirely. Nevertheless, it is still my position that if a person can create a tuning which sounds good using techniques which are not well-based theoretically, or illogically, the final product justifies the means. It does not matter how one gets there, so long as they do.

I will attempt to answer Ward's first question to the extent that I can comment on whether the procedures are well-based theoretically or logically.

Ward states at the end of his third paragraph that his first two steps are standard. They ought to be standard, but unfortunately, I doubt they are. The first assumption is that everyone uses an "A" fork, or an "A" reference. In spite of all of the efforts of the Piano Technicians Guild, including a modification of the Pitch Score in the Tuning Examination with reference to A-440, and a resolution passed by the Piano Technicians Guild at the convention in Toronto in 1987 recognizing A-440 as our pitch standard, there are still those who persist in using other notes as their reference. This makes no sense from a theoretical standpoint, and is highly illogical since it is infinitely more difficult to set note A-49 to 440 hz starting with any note other than A-49, and a 440 reference. (I sound

like Mr. Spock.)
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Even of those who use an "A" fork. not all use note F-21 as a reference to test the accuracy of the tuning of note A-49. Some choose to use no reference at all. This is dangerous because it is difficult to directly transfer pitch from a reference to an inharmonic string. Any of you who have seen an orchestra tune will recall that after the "A" is played, almost immediately other notes emerge. This is partially because the string players have three other strings to tune, but also because it is easier for them to tell when the "A" is in tune when they also have the "D" to compare it to. The same holds true for us. The choice of a reference is highly critical to us as piano technicians because we are dealing with an inharmonic instrument. The wrong reference note could cause us to listen to the wrong inharmonic partial, and our pitch may not be where we think it is. Let us look at a case in point. Say, for example, we chose F-33 as our reference note, instead of F-21. F-33 is a M10th below A-49. The ratio of a M10th is 5:2. Assuming that our pitch source is harmonic, the second harmonic of 440 is 880. If we match the beat rate of F-33 and our harmonic pitch source to the beat rate of F-33 and A-49, we have tuned the inharmonic second partial of A-49 to 880 hz. Because A-49 is inharmonic, it follows that if its second partial is tuned to 880 hz, its first partial will be flat of 440 hz. If, on the other hand, F-21 is our reference, we have a M17th between the note we are tuning and our reference. The ratio of a M17th is 5:1. When we match the beat rate of F-21 and our 440 pitch source to the beat rate of F-21 and A-49, we have tuned the fundamental of A-49 to 440 hz, which is what we set out to do. I might add that this can be done with an extreme degree of accuracy (less than 0.1 cents if you are careful).

In spite of all of my arguments, if you can tune using a "C" fork, and a reference a M10th below, and wind up with the fundamental of A-49 at 440 hz, my hat is off to you.

Ward states that he next tunes A-37 to A-49, using the M3-M10 test. In paragraph four, he states that he next tunes note D-42, and that the 5th from D-42 to A-49 should be at the same rate as the 4th from A-37 to D-42. If we tune A-37 to A-49 using the M3-M10 test, we have tuned a 4:2 octave between these notes, because the ratio of a M3 is 5:4, and the ratio of a M10 is 5:2 (the 5's being common, hence the comparison of 4 and

2). Referring back to the "On Pitch" series, and subsequent references, we find that the P4-P5 is also a test for the 4:2 octave, because the ratio of a 4th is 4:3, and the ratio of a 5th is 3:2 (the 3's being common, hence the comparison of 4 and 2). Since note D-42 is the note which is the test note for the P4-P5 test between notes A-37 and A-49, the beat rate of the 4th and 5th will be the same, regardless of where note D-42 is tuned, the A-37 to A-49 octave having already been tuned using the M3-M10 test. This is because as the 4th becomes more expanded (and beats faster), the 5th becomes more contracted (and beats faster), and viceversa. In summary, the 4th and 5th will be equal beating in this case because the 3rd and 10th were equal beating.

Since several tune the octave A-37 to A-49 such that the M10 is faster than the M3, say by 0.5 BPS, in this case the 4th will be faster than the 5th (by 0.5 BPS) regardless of where note D-42 is tuned.

Ward also mentioned that he tested the 4th with the M3-M6 test, and the 5th with the M6-M10 test. In both cases the test note would be F-33. If F-33 to A-37 = F-33 to A-49, then F-33 to A-37 < F-33 to D-42 by the same amount that F-33 to D-42 > F-33 to A-49. As we can see, the placement of D-42 in this case can be ambiguous, and the tests for the 4th and 5th will not help, except to show if the 4th and 5th are on the proper side of just. In this case, how the 4th and 5th "sounded" would be our only guide.

Ward stated that the fourth note which he tuned was E-44 to A-49, a 4th. Since E-44 does not share a common partial with A-37 and A-49 as did D-42, the equal beating relationship between the A-37 to E-445th and E-44 to A-494th does not exist. Here again, we are left to intuition as to what "sounds good" for our placement of note E-44.

If we accept the premise that in the midrange of the piano the 4th should always beat faster than the 5th sharing a common lower or upper note (A-37 to D-42 > A-37 to E-44, and D-42 to A-49 < E-44 to A-49), then the placement of the D and E between the two A's becomes a little easier. I believe that establishing these relationships would be more valid than setting the E-44 to A-49 4th at the same speed as the A-37 to D-42 4th, for the above reasons. What is important is the establishment of some primary temperament notes from which the secondary temperament notes can be tuned.

Ward's second question has to do with the beat speeds of the 6:4 relationships of the 5ths in the temperament. What Ward implies here is that there are two relationships for the fifths which we tune, one at the 3:2 level and one at the 6:4 level, hence two sets of beats which we hear. In piano tuning, it is the 3:2 level with which we concern ourselves. However, as Ward states the beats at the 6:4 level are faster and sometimes easier to hear, and are certainly not to be ignored when obnoxious. As Ward mentions, the problem occurs when the lower note of the 5th is the first wound string. In poorly scaled pianos, the inharmonicity constant can drop to about half that of the previous note. Let us look at an example (Example 1) where in one case, F*-34 is a plain wire, and in the next case it is a poorly designed wound string: (Note G-35 is included for relative cent and beat comparison).

As we can see, the beat transition is fairly smooth when F*-34 is a plain wire, but when F*-34 is a wound string with a much lower inharmonicity constant, and the string is tuned for a smooth progression in the M3, P4, P5(3:2), and Oct(4:2), there is a 1.2 BPS drop in the 5th at the 6:4 level. There is really not much which can be done about it, except designing a

Example 1						
Root Note: 0	G-35 Inharmon	icity Constan	t: 0.245 (Plain	Wire)		
	M3(5:4)	P4(4:3)	P5(3:2)	P5(6:4)	Oct(4:2)	Oct(6:3)
Cents:	14.0	2.7	-0.6	-2.2	1.4	-0.4
Beats:	7.8	1.2	-0.2	-1.5	0.6	-0.3
Root Note: I	#-34 Inharmo	nicity Consta	nt: 0.228 (Plai	n Wire)		
	M3(5:4)	P4(4:3)	P5(3:2)	P5(6:4)	Oct(4:2)	Oct(6:3)
Cents:	14.1	2.7	-0.5	-2.0	1.6	-0.1
Beats:	7.4	1.2	-0.2	-1.3	0.7	0.0
Root Note: I	F#-34 Inharmo	nicity Consta	nt: 0.125 (Wo	und String)		
	M3(5:4)	P4(4:3)	P5(3:2)	P5(6:4)	Oct(4:2)	Oct(6:3)
Cents:	14.6	2.3	-1.7	-0.5	1.2	1.5
Beats:	7.7	1.0	-0.5	-0.3	0.5	0.9

new string with a higher inharmonicity constant. If the string were tuned for an even progression of the 5th at the 6:4 level, all of the other intervals would sound bad.

Ward's final question has to do with the tuning of the treble, specifically, requests to tune the treble sharper than it should be. It is my feeling that what the customer wants (within reason) is right. It is, after all, their piano, and they are the ones who will listen to it until they have it tuned again, preferably by you, if you tuned it how they like it. This reminds me of a story. A local dealer sent me out to do a private tuning. By the name on the work order were the comments, "This is a crazy lady." I arrived and rather uneventfully began tuning the piano. When I was about a third of the way through, the customer came in to the room and asked at what pitch I was tuning the piano. I responded, "A-440." She then asked if that was the pitch that the symphony tuned to. I said, "No, they tune to A-442." She replied that they tune much too low. She knew this because she herself was a violinist, and she said she had perfect pitch. Knowing that most violinists like the pitch high, I asked at what pitch she would like to have the piano tuned. She replied that she was not sure, that she would have to get out her violin and see. I waited patiently, and a few minutes later she emerged, violin case in arm. She opened the case and revealed the instrument which had three of the four strings missing. She attempted to play the string, but to no avail. She was still, however, emphatic that the symphony tuned too low, and that she simply could not have it. Not knowing exactly where to go from here, yet maintaining my composure, I stated, "Well, I tell you what. I'11 start pulling the note up, and you just tell me when to stop."

Concerning the treble, it has been my experience that very few customers have any opinions about the tuning. They more or less leave it to us to do our job. I know that the tuning exam requires the controlled tuning of single octaves in the top octave. At the same time, there is a wide tolerance in that section. It is my impression that there is more of a trend toward double octaves in the treble than single octaves, or a good compromise between the two. This subject has been covered in depth in the "On Pitch" series, February 1984, pp. 29-31, and December 1984, pp. 27-30. You

may remember that this subject was touched on again in the discussion of "The Picasso Tuner" in April 1988, pp. 20-22. In general, double octave tuning is done in the treble of concert grands, and I attempt double octave tuning in all of my work if the piano will let me.

Our thanks to Ward Guthrie for his letter and thought-provoking questions. Our next letter comes from John F. Morehouse, of Cypress, California. John writes:

Last February at the California State Convention, I spoke with you after you had just finished your tuning class and said, "Did you know that you tuned a 10:5 octave from C3 to C4?" You replied that the octave from C3 to C4, as set up by the Accu-Tuner is supposed to be a 6:3 octave. I told you that I had checked the octave using C3 to A4 and C4 to A4. (The coincident partials of these notes are at E6, which identifies this test as the M13-M6 test for the 10:5 octave). I told you at the time that I could be mistaken because of the conditions at the time. But what follows is an example measured with an Accu-Tuner.

The piano tested has a stretch number of 4.7, arrived at by the usual method of playing note F4, and measuring the difference with the tuner set first on F5, then F6. The piano was the stretch tuned from C3 to F6. The following measurements were then taken:

NOTE	ACCU- TUNER SET ON	CENTS	OCTAVE TYPE
C4	E6	-8.2	10:5
C3	E6	-8.2	10:5
C4	C6	3.2	8:4
C3	C6	2.8	8:4
C4	G5	3.6	6:3
C3	G5	2.8	6:3

When this condition occurs, it seems to me it would be necessary to make some adjustments to pass smoothly from C3 to B2 and downward.

I would like to thank you for the contributions you have made to piano tuning. They are very helpful.

The Stretch Calculator has been described in detail on more than one occasion in the last couple of years. The most recent description was in the convention review of Dr. Sanderson's class by Peter Briant which appeared in the September 1988 issue, pp. 20-21. The

Stretch Calculator is actually tuning wide 4:2 octaves by the time you get to the bottom note, which is C3. It is possible that this wide 4:2 octave could be at the same time, a 10:5 octave, though this would be unusual. The situation would be similar to the one described in answer to Ward Guthrie's question about beats in 5ths at the 6:4 level, where the inharmonicity changes drastically and suddenly. The Stretch Calculator assumes two things: 1) That the note you are measuring the Stretch Number on is characteristic of the notes around it, and 2) that the inharmonicity progresses smoothly from note to note. At the break in many pianos, or where there are wound strings present, it is always a good idea to test all of the intervals (as in the example of the wound string above) to insure that each type of interval is behaving as desired. Where there is an irregularity in the scale, it calls for each note to be treated on an individual basis, as we do when we tune the bass. This is something which we should check aurally on each piano we tune.

Our thanks to John Morehouse for his letter and observations. Our next letter comes from Dennis Gorgas of Seattle, Washington. Dennis writes:

It is obvious from looking at the inharmonicity formulas for wound strings that the total inharmonicity constant "B" can be altered by changing the core inharmonicity or the end inharmonicities. Since it is possible to design two strings with different sized cores and unwrapped ends which would have the same total inharmonicity constant, will they also have the same tonal characteristics, or is a string's tone dependent on the manner in which we alter the inharmonicity?

Dennis' letter also included specifications for two different strings which would have the same inharmonicity constant. He noted that while the inharmonicities were the same, the percent of breaking strength and elongation were different. I asked Dr. Sanderson about this, and it was his feeling that as long as both strings had the same tension, they would sound the same. While no studies have been done to prove this, there seems to be no indication that we can distinguish aurally between core and end inharmonicity. As we know, altering the tension of a string will change its tone and to a certain degree, alter the inharmonicity. As long as the overall diameter is maintained, the size of the core wire will not change the tension. It will change the inharmonicity and percent of breaking strength. Changing the lengths of the unwrapped ends changes the inharmonicity but not the tension. So, it is possible to design two strings with the same overall diameter, one with a larger core (higher B core) and shorter unwrapped ends (lower B end), and another with a smaller core (lower B core) and longer ends (higher B end), which have the same total B and the same tension and should both sound the same. If the inharmonicity is altered by changing tension, however, the strings will sound different. The practical consideration here is that the finest copper available for the wrap is about .006 inches. This often necessitates the use of a lighter core to facilitate the desired overall diameter and tension. The net result is that the inharmonicity constant will be much lower than desired unless the unwrapped ends are made longer to compensate and bring the inharmonicity back up. This is the problem which was described relating to Ward Guthrie's guestion about the beat speeds in the 6:4 5ths. Sometimes this small core leads to a string with a high percent of breaking strength, and you guessed it—broken strings. As a general rule, it is best to use as large a core wire as possible, taking into account the limitations of copper sizes, to achieve the desired overall diameter and tension. This will keep the percent of breaking strength down as low as possible, and the inharmonicity up and in line with its neighbors, so that the unwrapped ends need not be unduly long.

Our thanks to Dennis Gorgas for his letter, and another interesting question. Again, our thanks to all those who wrote letters and asked questions. This is how our forum works.

Reader Responses

Our first response comes from Virgil Smith, of Chicago, Illinois. It is in response to articles in the August 1988 and September 1988 issues. Virgil writes:

I feel strongly that any wrong information in the Journal by statement or implication should be corrected when possible so that our readers have the benefit of as much truth and correct information as possible. In addition, they ought to be exposed to other legitimate approaches to a given subject as long as they are not crack-pot ideas.

Many of our readers need all the help they can get from the Journal, so it ought to be as accurate and as broad in its perspective as possible. Here are some clarifications and other points of view I think are worthy of consideration.

- 1. The 4th and 5th should not be tuned at the same beat speed. On page 21 of the September '88 Journal, it is stated that they are tuned "at almost the same speed." I know it says "almost" but this gives the wrong impression, and ignores one of the most helpful devices in tuning an accurate temperament and octave stretching. All theoretical tables list the 4th as being slightly faster than the 5th, but the difference can be greater, depending on the amount of inharmonicity. Keeping the 4th faster than the 5th with a common top or bottom note is an excellent way of insuring proper stretch of the octave in both directions from the temperament.
- 2. In the September '88 Journal, p. 22 it is stated that there are many ways to tune a temperament, and it really doesn't matter which method is used as long as equal temperament is achieved. True, there are many ways to tune a temperament, but it does matter which method is used. All roads may lead to Rome, but some may take much longer than others. Can we as tuners afford to take the longer, scenic route in setting the temperament? Now that we no longer have specific beat speeds to guide us, we need a temperament that will help us find the correct beat speed for each interval on the piano we are tuning early in the interest of time and efficiency.
- 3. The fine article on beats in the August '88 Journal, p. 34, treats very thoroughly the subject of beats at the unison, but fails to include beats occurring between different pitches. Many tuners believe that beats occur only at the unison, either between fundamentals of the same pitch, or coincident partials at the same pitch. It is important that tuners understand that beats can be heard between two different pitches, especially the octave. This is vital in tuning the best octave. You have often correctly pointed out in your writings that the best octave may not occur no matter which set of partials is matched. This is because the exact pitch of each note of the octave is determined by the input of the fundamental and each contributing partial with their various degrees of inharmonicity, and can be different than the isolated partial or any single partial. The ideal octave is achieved when the whole sound pitch of one note of the octave is tuned beatless to the whole sound pitch of the other note of the octave. Beats or a beatless situation can be heard by comparing the pitch of the lower note of the octave with the pitch of the upper note of the octave. Inciden-

tally, this is the way musicians listen to the octave. Matching partials and octave checks can be of much help in finding the best octave, but the final decision must be an aural one. It is important that every tuner (aural or electronic) learn to hear the beats or lack thereof between the two pitches of the octave. Electronic tuners can do many wonderful things the ear cannot do, such as isolate, measure the pitch, and determine the amount of inharmonicity of the fundamental and each partial, but they do not yet have the capacity to accurately measure the pitch of the whole sound of each note.

4. In the August '88 Journal, p. 36, it is stated that the minor third is not used in tuning equal temperament. On the contrary, many of us find it a very valuable interval in tuning an accurate temperament and octaves just below the temperament. If minor 3rds do not progress consistently, 5ths on the bottom note of the minor 3rd and M3rds on the top note of the minor 3rd cannot progress consistently.

Much success to you in your work.

I will attempt to clarify as much as possible each of the four areas which Virgil touched on.

- 1. The passage to which Virgil refers in the September '88 Journal, p. 21, is discussing contiguous intervals. It states, "Therefore two contiguous Major Thirds should beat in the ratio of four to five..., two contiguous fourths should beat in the ratio of three to four, and two contiguous fifths should beat in the ratio of two to three. However, on the piano this theoretical relationship holds well only for the major and minor thirds. The fourths and fifths are so strongly affected by inharmonicity that these contiguous intervals beat at almost the same speed. "From this it is clear that the author meant that contiguous fourths beat at almost the same speed, and contiguous fifths beat at almost the same speed, not that temperament fourths and fifths beat at almost the same speed.
- 2. Concerning methods of tuning, I still contend that there are many ways to achieve something if the end goal is clearly defined. The end result is what we judge. It does not matter if the temperament was tuned with fourths and fifths, thirds and sixths, or an Accu-Tuner for that matter, as long as the temperament sounds good in the final analysis. Of course, some ways are better than others to us. Methods are important to the extent that they facilitate the end result. But it is the end result

alone which we should judge artistically.

3. In my opinion, the concept that beats occur between different pitches is false. Beats occur between frequencies which are within about 16 BPS of each other. Beyond that, our ear does not hear them as beats anymore. This can be graphically demonstrated by considering an instrument such as a synthesizer playing square waves. Since square waves have only odd harmonics present, there are no beats when Major 3rds are played because there is no fourth harmonic of the upper note to beat against the fifth harmonic of the lower note which is present. Traditional instruments such as the clarinet, which only has odd harmonics present, react in the same way. In fact, when two clarinets play notes an octave apart, there are no beats at all in the octave, since there are no even harmonics in the lower note to beat against the corresponding harmonics of the upper note. It is impossible to tune an octave in the piano which is totally beatless, contrary to Virgil's claim; therefore, the ideal octave is achieved by tuning all audible partial levels as beatless as possible. This compromise can often be achieved by matching a particular set of partials if the resulting beats in the neighboring partials cooperate, though at times the best compromise is when none of the partials are beatless, but all as slow as possible.

4. The final reference is also to the August '88 Journal, p. 36. It states, "One other interval which does not even occur in equal temperament can be found by referring to the minor third again in the chart...." It goes on to explain that in addition to having beats at the 6:5 level (which we hear in equal temperament) there are also present in the minor third beats at the 7:6 level, and that these beats do not become present until the minor third becomes so narrow that the 6:5 level becomes a buzz. Only then are the 7:6 level beats heard, and this interval is called a "small minor third" which is used in many historical tunings, but not in equal temperament. To repeat, it is the minor third at the 7:6 level called a small minor third which is not present in equal temperament, not the traditional minor third at the 6:5 level which is very useful, as Virgil indicated.

Our thanks to Virgil for his letter of response to articles which have been printed in the August and September

issues. I hope that this has cleared up any misunderstandings any of you may have had on these four points. Our next response comes from Hiram T. Hunnicutt of St. Louis, MO. It is in response to an article in the April '88 issue, I assume (though he does not specify) dealing with the "Picasso Tuner." Hiram writes:

I have been a reader of the Piano Tuners Journal, and the earlier magazine for more than 30 years. After re-reading the April '88 issue, I believe this is a proper time to tell you about my concern.

I am unable to relate the discussion of piano tuners to the discussion of psychologists. The piano tuner talks about Hz and the inharmonicity of piano wires. The psychologist talks about Hz and the perception of pitch. According to the psychologists, pitch exists only in the brain. It is the way the brain perceives the stimulus. The discrepancy is in the functioning of our senses, not in the piano wires. None of our senses are a one-to-one, straight-line relation. The psychologists have collected scientifically controlled data to prove it. Our perception of pitch is no exception.

According to this view, no matter how sophisticated electronic tuning devices become, an electronic tuning will always be a crude approximation of a skilled aural tuning—the best that an aural tuner can do.

The inharmonicity exists in the piano wires, not in our brains. I am sorry that I do not share your view of electronic and aural tuning. Our thanks to Hiram T. Hunnicutt for his response. Our next response comes from Conrad Hoffsommer, of Decorah, IA. Conrad writes:

I am writing to you in reaction to Virgil Smith's article "The Tuning Touch" in the August 1988 Journal. As a college technician and instructor, I appreciate Mr. Smith's contributions to the field as a teacher, technician, and pianist, but feel duty bound at the same time to disagree with the opinions expressed by him in that article.

I agree totally with him when he says, "...one must tune with a solid blow to achieve tuning stability." I also concur that testing with a harder blow does not seem logical. Where I begin to disagree is when he states that there "...cannot be two touches, one for stability and one for hearing." In the past, I tuned using as hard a touch as possible on every stroke, knowing that, while a concert pianist playing Liszt will make that concert grand bounce on the stage truck as they attempt to duplicate his feat of demolishing a piano during a recital, they will not succeed

as long as I have it in good repair and regulation. The only thing they may do is knock it out of tune.

As a result of carpal tunnel release surgery on both wrists in the last year, I felt there must be a better way to achieve accurate and stable tunings and still be kind to the only body I will ever have. I use a light touch while I am manipulating the tuning hammer, and "aim high,"—that is, I listen until I know I am slightly sharp of the desired pitch. At that point, I come down with a "settling" blow, using my tuning hand, then I listen again after a soft "listening" stroke. If I overshoot, I, of course, repeat the process, but the second time I know better how far that particular string is going to move. The softer blows allow my hands and wrists to "coast" or rest, and the fewer loud blows are easier on my ears. It may sound cumbersome, but I am again doing tunings in my usual length of time.

The next problem with Mr. Smith's article concerns physics and mechanics. He states, "The two physical factors involved affecting piano sound are speed and weight." So far, not bad, but he goes on to say, "...how fast the key is depressed and how much weight is used to depress it." If I were grading that as a quiz, I would give partial credit.

The speed of the hammer is what is important here, as well as the weight (really mass) of the hammer. From my understanding of the sequence of events in the action when playing the piano, the hammer and shank are in free flight after escaping from the jack (and balancer in grands) so that the factors involved at the impact of hammer and string are the mass of the hammer times the acceleration given by the force applied at the other end of the key.

The weight of the object used to move the key is irrelevant as long as it can somehow propel the hammer to the proper velocity. My eight pound cat can get sound out of my piano at home, but I can gently sit on the keys without making a sound, so mere weight cannot be the factor involved. If you can listen (eyes closed) to a piano being played and not be able to tell if the player is human or machine (possibly computer aided) then it seems to be evident to me that the velocity of the hammer is the key (pun intended).

The mass of the hammer is determined by the factory and the technician. If you were able to replace the hammers on that reproducing grand with, say 12 pound hammers, the sound you would hear would be different, to say the least! What was changed? Velocity? No! Only the mass, which, when coupled with the original ve-February 1989 Piano Technicians Journal. — 19

locity, could never hope to excite the strings as before. The only keyboard instrument I can think of right off hand in which weight upon the key is a factor is the clavichord, and tuning one of those is really an exercise in even key pressure.

The last area in which I disagree is listening for beats. Mr. Smith states, "In tuning, greater emphasis on the top note can improve the sound and make the beats easier to hear. This is especially true when listening to 17ths." It does not seem logical to me that the weaker amplitude of the fifth partial from the lower note would be heard clearly against the fundamental of the upper. I would think that, in order to compete more fairly and set up a good interference pattern (beats), the amplitude (strength, loudness) of the lower note's partial should be increased. The larger the interval, and therefore the higher partial being used, the more emphasis on the lower note would seem imperative.

There are three issues here: 1. the amount of force needed for stability, and frequency of use, 2. the effect of weight in creating the piano tone, and 3. the relative emphasis of the notes of an interval when listening for beats.

I can see merit in both approaches to tuning, one with soft blows for listening, followed by a hard blow for stability, and the other which employs hard blows throughout. I have tuned both ways. I was taught the former method, though I must admit I now

favor the latter. I have found that the better my hammer technique has become, the softer my hard blow has needed to be to achieve tuning stability. There seems to be something about the hard blow occurring at the same time that the tuning pin is being moved that helps to settle the string better than other methods which I have tried. There seems to be less wasted energy as well, because the "overshoot and retry" syndrome is lessened. The medical implications here, however, cannot be overlooked. I am sure that the consistent hard blows are harder on our fingers, hands, and wrists than softer blows would be.I am sure that the position of our fingers, hands, and wrists are critical to our body's wellbeing in light of the abuse we are imposing upon these parts.

I do not care to comment on the subject of weight as described above. As to the issue of emphasis of the notes of an interval when listening for beats, there are several factors to be considered. The lower notes of the piano are louder than the upper notes when played with the same pressure. Virgil did not say specifically to play the upper note louder, but to put more emphasis on it. This could mean playing it louder, but it could also mean placing more of the emphasis of our hearing on the upper note, since in the case of the 17th, the upper note itself is the pitch at which the beats are heard. Also implied is that if

the lower note is played more softly, the beats will be cleaner, less distorted, and therefore easier to hear. Often, our ability to hear the beats of an interval can be enhanced by separating the attacks of the two notes. This is done by playing the first note and sustaining it, then quickly playing the second note. A little experimentation with emphasis and timing will refine this technique.

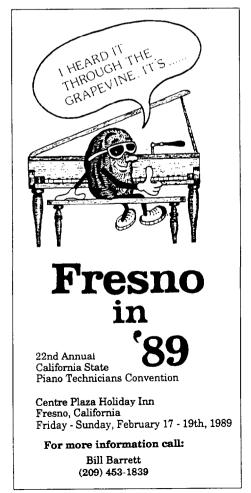
Our thanks to Conrad Hoffsommer and all others for their responses. Believe it or not, there are still letters and responses which I have not included this month. We will save them for the future. If you have a comment about something which you read this month or have a question or suggestion for a subject which you would like to see covered, please let me hear from you.

In closing, please enjoy "Some Thoughts on Stable Tuning" by Daniel Bowman of the Richmond Chapter.

Please send your questions and comments to:

Rick Baldassin 2684 W. 220 North Provo, UT 84601





AT LARGE

The Fandrich Vertical Action

Darrell Fandrich and Chris Trivelas

N o part of the piano has given the inventor more food for thought and opportunity for display of genius than the action. The experiments made are almost numberless and it may be said that every thinking piano maker has at one time or another fallen victim to the lure of inventing a new action. Even the author in his early days sent his hardearned dollars to Washington to pay the fees for a patent for an 'improved upright action." (Alfred Dolge, Pianos And Their Makers, p. 83). Well, so have we.

Our project began six years ago with the idea of designing a vertical piano that would capture more of the excellence we admire in grand pianos. Our first focus was on scale design. However, we soon realized that it was not so much scale design as the action that was the bottleneck. What we wanted was a vertical piano of good scale design with the action of a grand.

There are several hundred patented "improvements" to the vertical action, but none that have achieved any significant success. We found this intriguing and intimidating.

How could so many patented improvements fail to hit the mark? Why has the traditional vertical action design remained the standard for well over a century with basic performance problems so often highlighted by the preference of pianists for the action of the grand?

Our study revealed a number of good reasons why the traditional vertical action has endured, not the least of which are its own merits. Basically, it is an amazingly good design that can only be faulted by comparing its performance to that of the grand action. Indeed,

most of the patented "improvements" fail because they improve one aspect of performance at the expense of another, so that in the overall balance of compromises they do not work as well as the traditional design. That is, their scope was too limited.

For example, the more promising "improvements" attempt to improve repetition with some sort of repetition spring. The basic design of the vertical action calls for the wippen and key to fall faster than the hammer in order to separate the parts to make room for the jack to re-engage. The more effective these repetition springs are, the more swiftly they separate the parts, which means that they overshoot more easily to create a lost motion gap due to their motion, dynamic lost motion (DLM). In this way, repetition is a trade off with DLM, and the traditional vertical action balances this tradeoff quite well. Even if the problem with repetition could be resolved independently the way the vertical action repeats, there still remain the problems of lost motion and inadequate inertia.

In order to write a description of our own "improved" vertical action that is understandable and of reasonable

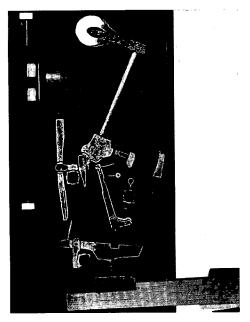
We soon realized that it was not so much scale design as the action that was the bottleneck. What we wanted was a vertical piano of good scale design with the action of a grand. length, it is necessary to put it into a form that is logical, rational and linear. This form implies that our development process was similar, but in actual fact we did a great deal of groping in the fog with many dead ends and retraced steps. We have several boxes of parts that have spent some time on our action models being torture tested and analyzed, representing many thousands of experiments. And it is more in retrospect that it has become clear that our design criteria were:

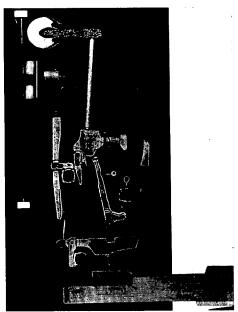
- 1. Play like a grand. The performance of the basic design of the Erard grand action, as modified and simplified by Herz, Steinway and others, has proven to be satisfactory by well over a century of experience. Because any "improved" vertical action will ultimately be judged by comparison with the grand action, it seems clear that any "improvement" will need to equal the performance of the grand action for it to create enough demand to effect marketability.
- 2. Cost effective to manufacture. It must not be significantly more expensive to manufacture than the traditional design.
- 3. Easier to service than a grand, and except for the necessary addition of a repetition spring adjustment, no more difficult to service than the traditional vertical design.
- 4. More durable, with parts and adjustments lasting at least as long as the grand.
- 5. Tradition. It must fit into both the traditional style of construction and the traditional concept of the vertical piano as being a less costly to purchase and maintain alternative to the grand piano.

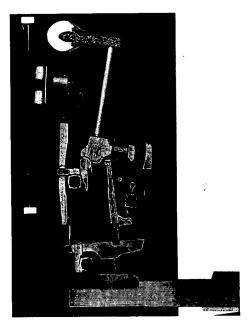
With reference to our previous article, Differences Between Grand And

Vertical Piano Actions, the grand action

^{@ 1988,} by Darrell Fandrich and Chris Trivelas for submission to The Piano Technicians Journal.







has no lost motion because the hammer effectively rests on the jack. It can do this because the re-engagement of the jack is assured by the separation force of the repetition spring. This separation force can be strong enough to be effective because its force is restricted to the function of jack re-engagement by the boundaries set by the repetition lever and the drop screw. With re-engagement assured, the weight of the hammer can provide the force to return the key to the at-rest position after play. This means that key weights can be used to counterbalance hammers that otherwise would be too heavy for a reasonable touch weight. These key weights also insure adequate inertia for a pressure sensitive touch. The problem with DLM is minimal because the tendency of the parts to overshoot after re-engagement due to their inertia is restrained by the opposed forces of the hammer weight and playing-end key weight that act to keep the parts in close contact.

For an "improved" vertical action design to "play like a grand" it must therefore adapt these same principles:

- 1. Hammer to rest on the jack to eliminate lost motion.
- 2. A repetition spring to provide a separation force to enable jack re-engagement.
- 3. Means to restrict this separation force to the function of achieving jack re-engagement.
- 4. Opposed forces to keep the jack in close contact with the hammer butt to eliminate DLM.
 - 5. Adequate inertia.

The Fandrich Vertical Action

(patent pending) is a vertical action design that adapts the above principles, and therefore, is the functional equivalent of the grand action. It looks familiar for it retains the traditional vertical damper, hammer butt, wippen and key assemblies. The noticeable differences are the elimination of the bridle tape and wire and the replacement of the jack spring by a repetition spring that links the jack with the hammer butt.

More specifically, the Fandrich action can rest the hammer on the jack because the repetition spring provides a separation force to assure jack re-engagement. This separation force is restricted to the purpose of achieving jack re-engagement by the natural function of the geometry of the design. The opposed forces to keep the jack in close contact with the hammer butt are provided by a gravity strength hammer return spring and by counterbalancing weights in the playing end of the key. These key weights also provide the additional inertia necessary to achieve the inertial characteristics of the grand action.

The repetition spring is a safetypin type with a small coil of two loops from which extend two three-quarter inch arms that make an approximate right angle with each other. The ends of these arms are pivotally attached to points on the jack and the hammer butt. The locations of these points are important, for they determine the action of the line of force of the spring. On our prototype piano, a restored 1909 Steinway K52, the operating plane of the repetiton is on the bass side of the jack and hammer butt for ease of installation and adjustment. The clearance for this asymmetrical location is adequate and the small force moments that result are not significant. The attachment to the hammer butt is a hook-the-pin type for ease of adjustment and disconnection.

Before let-off, the repetition spring functions only to keep the jack engaged with the hammer butt. It begins to function as a repetition spring with the development of separation force that begins with let-off. When the backchecked position has been reached, two of the three movements that produce separation force have occurred. First, the repetition spring has been compressed because escapement brings the ends of the spring closer together. And second, the line of force of the spring is now such that it has greater leverage over the hammer butt and has a more favorable alignment with the jack to urge the return of the wippen and key. At this point, the force available is sufficient only to support the hammer, not to lift it, which means that backchecking is easier because hammer rebound is only minimally impeded. The third movement is the release of the key which allows the jack to press against the hammer butt. This pressure adds a camming or wedging force to the spring compression and the more favorable leverage, which increases the total separation force to an amount sufficient to push the hammer toward the strings. The adjustment of the repetition spring is the same as the equivalent adjustment in the grand action, with the spring force being adjusted to achieve the proper movement of the hammer toward the strings.

It is important to restrain the separation force of the repetition spring after escapement but before re-engagement in order to prevent the hammer from involuntarily re-striking or blocking against the strings. In the grand action this restraint is provided by the drop screw. The separation force also needs to be restrained after re-engagement to prevent the formation of lost motion. In the grand action this restraint is accomplished by the repetition lever adjustment. In the Fandrich action the separation force naturally abates at the completion of re-engagement as a result of the geometry of the design, i.e. the repetition spring decompresses, the leverage of the line of force decreases and the wedging effect disappears. This means that a repetition lever with its adjustment and a drop screw are not required.

The gravity strength hammer return spring is far stronger than the traditional spring. Its force is the same as if the hammer were mounted in a grand action and falling due to gravity. An adjustment screw is built into the spring rail for easy adjustment, which is accomplished by positioning the action with the hammers pointing down and the hammershanks essentially horizontal and then regulating the adjustment screws until the hammers are uniformly supported by the spring force.

Because the hammer return force is graduated from treble to bass according to the weights of the hammers, the keys can be weighted in the same manner as are the keys of a grand with more weights in the bass and fewer in the treble. This counterbalancing key weight opposes the gravity strength hammer return force to provide a reasonable touch weight and to keep the jack in close contact with the hammer butt to eliminate DLM. The key weights also assure adequate inertia.

Servicing the Fandrich action is the same as the traditional vertical action with three exceptions. The capstan screw no longer adjusts lost motion but a hammerline as in a grand action. And there are the two additional spring adjustments. The repetition spring is adjusted by bending the wire slightly with the aid of a spring adjustment tool:the same as adjustments to Steinway type grand repetition springs, but easier because the spring is more accessible and the action does not have to be re-

moved. The adjustment of the hammer return spring requires some preparation. The action needs to be removed and placed in a horizontal position, and the repetition springs need to be unhooked. The adjustment consists of evening out the hammerline made by the hammers as they are supported by the springs. The repetition springs are then re-hooked and the action reinstalled.

To compare serviceability, the grand action has four more basic adjustments than does the traditional vertical action: the adjustments of the repetition lever, the repetition spring, the jack alignment and the drop screw. The Fandrich action has only two more adjustments: the repetition spring and the hammer return spring. The repetition spring adjustment is easier than it is in the grand action primarily because of easier accessibility. Our experience with the hammer return spring adjustment in our prototype piano indicates that this adjustment is exceptionally stable and will seldom require attention.

Also, we expect the durability of the parts and adjustments to be considerably greater than that of the traditional vertical action. This is largely because of the lower stress levels due to the absence of lost motion and DLM, which make possible the use of much firmer cushioning materials at the capstan and hammer butt. The absence of lost motion and DLM also mean a quieter function.

The picture of our model action

indicates a few other points of interest. Because there is no bridle tape, the wippen rail has been relocated to support the wippen from beneath so as to limit the amount the wippen can drop when the action is removed in order to prevent the jack from disconnecting with the hammer butt. This location also makes possible easier access for damper spoon adjustment and also allows the spoon to be located on the line of centers of the damper and wippen flanges for less friction. The playing end of the key on this model and on our prototype is longer than usual, measuring ten inches which is comparable to most seven foot grands.

The performance of the action in our prototype has so spoiled us that we will never again be able to enjoy playing a vertical piano with a traditional action. Michiko Miyamoto, a fine pianist and highly respected instructor and adjudicator in the Seattle area, put it this way: "The first time I played on the new piano [action], I found it an amazing experience. It was difficult to believe I was not playing on a grand piano. I could see that I was sitting in front of an upright instrument, but the sensitivity of the touch and its capability of giving many degrees of shading and tone coloring were astonishing. Even grand pianos, unless they are the finest, do not respond with the gradations of tone which this upright can give."

Inquiries should be addressed to Fandrich Design Inc., 210 Third Ave. S., Seattle, Washington 98104. ■

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Our 9th Year

AT LARGE

Some Thoughts On Unstable Tuning

Daniel L. Bowman Richmond Chapter

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

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

The first step in setting a solid (stable) pin/string is to push/pull/bump/jerk/impact the pin through the marshmallow zone and get actual rotation of the pin in the wood. If you do not get movement in the wood, even though you have achieved a pitch change, you

have only sprung the pin/string unit out of its natural resting state, and hence the unit is unstable. The friction in the marshmallow zone will hold the pin/ string unit in that sprung, unstable state, but only for a while—plenty long enough to fool you; perhaps long enough for you to get out the front door, or maybe even for a week or so, or just until the next hard hammer blow. When you move that pin in the marshmallow zone without movement in the wood, you have changed the balance of forces between the pull of the string and the stiffness of the pin without giving a foundation or support for a new resting place. The new support is the new position of the pin in the wood into which it can then settle, or rather be settled.

The second step after getting this new position in the wood is to actively settle the pin/string unit back into its new resting place. Remember, when you finally did get movement of the pin in the wood, you first passed through the marshmallow zone and introduced a sprung condition into the pin/string system. The friction in the marshmallow zone will keep this sprung condi-

Coping with this marshmallow zone as the pin is rotated in either direction is what calls for professional-level skill on the part of the piano tuner.

tion from automatically correcting itself when you release the tuning hammer. You have to actively feel out where in the marshmallow zone the sprung forces are relieved and help the pin/string unit settle into that exact spot. Mentally keeping track of how far the pin/string unit sprung before the pin moved in the wood helps you more quickly locate the new resting place. The resting place is the point at which all sprung forces are out of the pin/string system leaving a balance of forces between the pull of the string (with tension equalized over its entire length) and the stiffness of the pin. I stress again that you must actively take charge of locating the new resting place and help the pin/string unit settle into this place, the place where it wants to settle, but cannot because of the "marshmallow's" friction.

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

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

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

The trick, then, to solid tuning is

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

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GOOD VIBRATIONS

Plate Suspension: Another Look

Nick Gravagne New Mexico Chapter

Of the various changes made in piano construction over the years, few capture the interest of the rebuilding technician as does Baldwin's grand plate mounting system. Since the system doesn't require special techniques or exotic tools—Baldwin's all-thread bolts being the only unusual items—this method of plate suspension finds complete applicability in the small shop. Although not a panacea, the process affords a degree of flexibility, accuracy and cool-headed control not previously available.

Since this article concerns practical plate fastening for the shop technician rather than Baldwin production processes, an involved explanation of Baldwin construction isn't necessary. In order to keep this article to a handy length, it will be assumed that the uniqueness of Baldwin's plate mounting system is generally understood. If not, refer to the Technical Forum, Jack Krefting, Oct. '85, and Tom Lowell's "Plate Suspension Systems...", July '85. These articles not only deal with this topic but include some nice drawings. In addition, the Baldwin company has been running a series of technical informative ads on their various design features. The plate mounting ad, for ex-

ample, appears on the inside of the *Journal* September '88 issue. Still, in order to maintain a sense of completeness and continuity in this article, refer to Figure 1 where the usual dowel support system is compared to the threaded Baldwin system.

At the inner rim Baldwin, grand plates do not sit on dowels or other supports;

in fact, they don't sit on anything. The usual lag screw found in most pianos is replaced by an all-thread machine bolt which, upon insertion, threads in and through the plate, then passes through an air space, and finally threads directly into the hardwood rim. When the bolt head has turned all the way down to the plate, the bolt stops and the system is securely locked. The relative position of the plate to rim remains unchanged. For a rebuilder, this plate positioning method is very attractive as it eliminates hassling with those intractable dowels.

In drawing A, Figure 1, notice that the dowel system requires a compressive force upon the plate and wooden dowel and corresponding tensile stress in the lag screw and the wood fibers of the inner rim. The dowels, of course, are completely responsible for setting plate height at the perimeter. At drawing Bit is obvious that, although there are no plate supports in the usual fashion, the height of the plate is absolutely set and held, initially and forever more, by the bolt. In contrast to the dowel system, the all-thread arrangement requires no opposing compressive and tensile forces and needs no retightening once set.

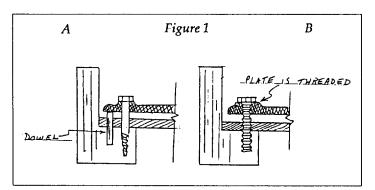
Before getting into the job-shop

specifics of plate fastening, a general discussion of the 'why and when' of plate positioning must preface. For this purpose our concern is with the up-and-down location of the plate (its Z axis) and not with the side-to-side or fore-and-aft locations (X and Y axes).

Generally, downbearing on the belly bridges is determined by plate height, not by the amount of soundboard crown or bridge height, as important as these are. In addition, the Z location of the plate must simultaneously set the string height (keybed to strings) as well as maintain a small space at the perimeter between the underside of the plate and top of the soundboard. Without this space the plate bosses will contact the soundboard. (Of course, many less expensive pianos have been designed with deep underplate bosses which serve to set plate height; these purposely contact the soundboard top at the rim).

In most new piano construction the one downbearing variable easiest to deal with is the bridge height. If the plate can be set to the designed string height over a uniformly thick pinblock (simplifies matters considerably), while at the same time set to maintain the

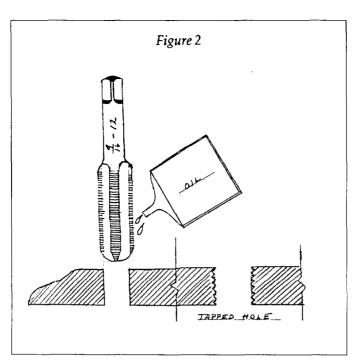
> aforementioned space under the plate perimeter, all that remains for setting a downbearing angle is planing down the bridge top. With a few modifications, rebuilders often follow the same sequence. Nevertheless, some manufacturers and some rebuilders prefer to plane and notch the bridge to a predetermined height and then set down-

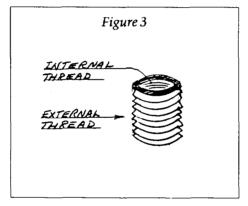


bearing by plate location and rear string rest manipulation. Whatever method is used, the plate must sit evenly and solidly on all perimeter supports including the pinblock. Should it come time to reposition the plate in order to accomodate, say, a new soundboard, the support dowels (or blocks, or continuous wood strips, etc.) will either have to be altered or removed and replaced. It is here where the joys of rebuilding can take a turn for the worse. Not only are dowels not dynamically adjustable, they are inaccessible unless the plate is out. Most technicians who have replaced dowels or trimmed their tops have declared: "There's gotta be a better way to do this!" There is.

In order to hang a plate per the Baldwin arrangement, some ordinary metal working tools and know-how are required—a fact which turns off some woodworking-oriented technicians. But the tools are inexpensive and easily had and their use considerably easier to master than, say, French verbs. Plates designed for lag screws usually contain 1/2" diameter unthreaded holes through which the lags freely pass. These holes must be tapped (threads cut in) in order to receive threaded inserts, which in turn receive the all-thread machine bolts. This is where the woodworker dons the machinist's cap. The necessary tools and supplies follow:

- —A 9/16-12 tap for cutting threads in the existing plate holes
- —Tee handle for holding and turning the tap (visegrips work)
- —Cutting fluid for lubricating the tap as it cuts (any light-duty oil such as 3-in-1 works)
- —Threaded inserts, one for each hole. These can be purchased locally or mailordered ready to go.
- —Insert installation tool (a bolt with locknut works)
- —All-thread bolts 3/8-16", one for each hole. Order from Baldwin with lock washer.
- —A 12" or longer 1/2" drill bit for opening the lag screw holes in the inner rim. The length is necessary for the drill tool to clear the outer rim. I use a short bit on an extension.





- —Hardwood dowels or plugs to fill the 1/2" rim holes.
- —A 12" or longer 5/16" drill bit for drilling the inner rim engagement holes which accept the Baldwin bolts
- —Soap or graphite paste for lubricating the bolts
- —A ratchet wrench with extension and suitable socket for turning in the bolts
- Thread locking compound such as Loc-Tite
- —A crescent wrench
- -Clean up rags

The Process

Tapping the plate with the 9/16-12 tap, (See Figure 2) secure the tap in the tee handle or grips, oil the cutting threads and start the tap in the hole with a downward pressure in a clockwise direction. Although the tap is more or less self-aligning, try to get it started straight in, i.e. square to the plate surface. Turn the tap until resistance is felt (about one full turn) and turn backward a quarter turn to allow the chips to fall through. Continue the turn and back-turn procedure until the tap has cut all the way through and is turning freely. Add oil as you go. These threads can be cut from the top or bottom of the plate, having no effect on the clockwise installation of the inserts. Still, I prefer to tap the plate from the top and install the inserts from the top as they seem to enter better from the tapping side. Clean the tapped hole and area with compressed air and rag and move to the next hole.

This process assumes that the old, unthreaded plate lag holes are reasonably round not oblong or otherwise misshapen as they sometimes are. Badly distorted holes are diffi-

cult to tap correctly and, even if possible, the outside diameter insert threads won't engage the plate threads as fully as they should. My rule-of-thumb has been to watch the tapping tool itself as it enters a slightly oblong hole; if it completely fills the hole showing no air spaces, I proceed.

The Inserts

These have two threaded surfaces, an outside and an inside. (see Figure 3) The outside diameter (OD), which matches the tap used to thread the plate, is designated as 9/16" and there are 12 threads per inch (6 per half-inch, etc.). The insert's inside diameter (ID), which matches the Baldwin bolts, is designated as 3/8-16. Inserts have various names but their purpose and application are well understood by the people who sell them. You might be able to find them in a well-stocked bolt and screw supply company in your area. If not, they are available through mail-order from:

MSC

151 Sunnyside Blvd.

Plainview, New York 11803

The Nationwide Catalog Sales Phone number is 800-645-7270. The ordering number for the inserts is 0684924. This is for the ordinary steel part with a nylon locking nub on the outside thread. The company refers to these parts as Re-Nu-Thread inserts. A recent order priced these at 95 cents each. But since there is a \$25 minimum

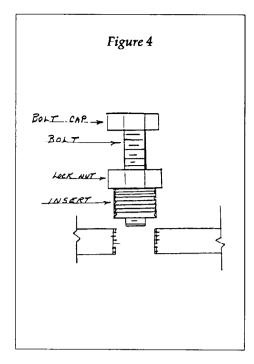








Photo 1

Photo 3

order, I had to order 27 inserts—enough to do two average size grands plus. Orders by phone require your MC or Visa number. My order arrived within a week.

To install, take one of the bolts and turn an ordinary 3/8" nut (most 3/8" hardware store nuts fit). Now turn the insert onto the same bolt and lock in place with the nut. Apply the lock thread compound to the plate threads and the insert threads. Install the bolt-locknutinsert assembly into the threaded plate hole and turn down until the locknut touches the plate. Use a crescent wrench to turn the assembly. (See Photo 1 for an installed insert and Figure 4 for a drawing of the assembly.)

The Inner Rim Lag Holes

These need to be bored to a 1/2" diameter and filled with 1/2" dowels or plugs. Glue in place and trim flush with the rim (new soundboards) or flush with the top of the old board if repositioning plate only.

Installing The Baldwin Bolts

When all inserts are in place, install the plate in over the pinblock and nosebolts. (Note the downbearing peculiarities and pitfalls at this juncture will be covered next time. Our only concern here is with installing the bolts). Install the pinblock screws and nosebolt cap nuts. The plate will now be secured to the pinlock and nosebolts but suspended at the perimeter. The inner rim holes which receive the plate bolts must

now be drilled out. Use the 5/16" bit. Using the installed inserts as guides drill straight down (Photo 2). If you're not good at this by eye, attach something to the outer rim to serve as a vertical reference guide. It may seem as though this operation will bung up the internal insert threads. It won't. The bit has adequate clearance and with reasonable care, very little sideways pressure will be applied to the threads. When the holes have been drilled, use compressed air to blow the wood chips to an accessible area of the soundboard for vacuuming.

If this seems impossibly messy, refer to Photo 2. Notice that a mushroom of chips is forming on the top of the plate. This is because the wood bit is drawing the wood chips up the flutes and depositing them in the most accessible open area. Vacuum them away. Relatively few chips are deposited on the soundboard.

Although it shouldn't be necessary, the plate could be removed at this time (or any future time, for that matter), as long as the usual care is taken to note its X and Y location. Take a bolt/ lockwasher in hand and lube the threads with soap or graphite grease and start it into the insert. Turn by hand until the ratchet is necessary. The bolt will turn through the insert, pass through the air space and then begin cutting threads into the 5/16" rim hole. Turn the head down far enough to flatten the lockwasher and it's done. Refer, however, to

Photo 3. Notice the block of wood and the bar clamp. They are exerting a moderate pressure on the plate so as to prevent the plate from springing upward when the bolt first makes contact with the hole. Once the bolt has engaged the hole and started cutting threads, the block can be removed. Move along from hole to hole and complete the job.

I have heard technicians express concern over what to do should the plate need to have its Z position altered; cross threading the inner rim would seem inevitable. The answer is as easy as simple addition. Since there are 16 threads per inch on the bolt, the plate's Z position can be raised or lowered by multiples of 1/16" and cross threading will be avoided. Of course, 1/16" would be the minimum amount that the plate could be moved. Still, considering the density of the hardwood rim, it seems that one cross threading would do no harm.

Since the 3/8" bolt has 16 threads per inch, they take more time to turn in than lags do—the only real negative aspect of this work. I calculated how many quarter turns were necessary to turn one of these bolts all the way down. I wished I hadn't. Wear gloves, switch on your automatic pilot and pull your ratchet rhythmically to the tune "Michael Row the Boat Ashore." If all has gone well up to this point, the "hallelujah" part will speak for itself.

ANTIQUE RESTORATION

Restoring Antique Pianos, Part IV: Stringing

Edward E. Swenson Ithaca College

I n the past few months work has progressed steadily on the Bösendorfer fortepiano in my shop. The stringing is finished except for 10 bass strings, which I am having made in England. The new brass and type C steel strings from Malcolm Rose have been tuned and chipped several times. (The instrument has a very strong, lyrical sound with remarkably good sustaining power for a fortepiano.) One odd feature of soft brass and low-carbon steel music wire is that its tone quality grows in strength during the first year after restringing. Judgements about the success of a stringing job with this wire should not be made in a hurry. Soft wire also takes much longer to stretch out and stabilize. After stringing it takes at least a month before an instrument is useable.

In my article in the March, 1988 Piano Technicians Journal, I commented on the original condition of the stringing in the Bösendorfer fortepiano which I am restoring for Cornell University:

Most of the brass-wound bass strings have broken windings and one is missing. These strings will be measured and saved, but they have to be replaced in restoration. All of the solid brass strings are broken. From the stumps of wire left on the tuning pins, it is possible to measure the wire sizes...Most of the original, low-carbon steel strings are intact, but they are very rusty. The loops on the string ends are occasionally varied in form, indicating the presence of replacement strings....Still most of the strings and the oblong tuning pins appear to be original.

From the beginning of this project, it was clear that all the original strings would have to be replaced. I want to reemphasize, however, that the original

strings in many early pianos can be cleaned and saved. Replacing original strings in rare antique instruments is a last resort best saved for circumstances where no other alternative is possible.

Measuring The Original Strings

To determine the wire sizes for the replacement strings, the old strings must be carefully measured with a micrometer. Because antique music wire is often slightly out of round, it is important to measure each string at several different angles to obtain an accurate average diameter. Heavily rusted wire may need to be cleaned with fine steel wool before measuring. After each string in the unison has been measured, I record the results on a form provided by Malcolm Rose. This form is shown on page 33.

One odd feature of soft brass and low-carbon steel music wire is that its tone quality grows in strength during the first year after restringing. Judgements about the success of a stringing job with this wire should not be made in a hurry. Soft wire also takes much longer to stretch out and stabilize.

Based on my measurements, I decided on the following stringing scale:

Unison # 6-9 Brass: .052" 10-11 Brass: .049" 12-14 Brass: .047" 15-18 Brass: .042" 19-20 Steel: .042" 21-23 Steel: .040" 24-31 Steel: .037" 32-39 Steel: .035" 40-51 Steel: .033" 52-58 Steel: .031" 59-64 Steel: .029" 65-72 Steel: .027" 73-80 Steel: .025"

Penciled at intervals on the bridge of the Bösendorfer are a series of black dots, which may have indicated the changes in the original stringing scale. According to these dots, the following unisons were strung with the same wire:

6-7

8-9 10-12 13-15 16-18 19-21 22-28 29-35 36-42 43-49 50-56 57-64 65-72 73-80

I cannot account for the fact that the wire sizes as measured in the instrument do not coincide with the changes indicated on the bridge. Unfortunately,

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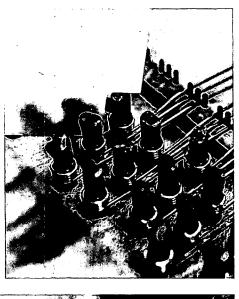
no actual wire gauges can be found anywhere in the instrument.

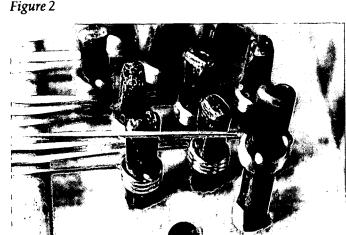
Stringing And Shimming Techniques

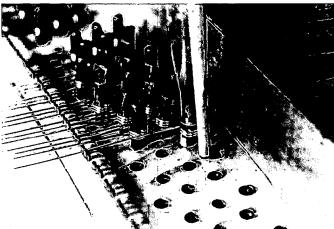
Before turning any of the original tuning pins, measure the average height of the tuning pins and wire coils above the pinblock. The tuning pin height can be transferred conveniently to a template cut out of a business card. (Illustration 1) Also count the number of coils on the tuning pin and the number of braids in the hitch pin loop. All these original features should be duplicated during restringing.

In my article in the May, 1988 *PTG Journal*, I described the method for removing and cleaning the tuning pins before returning them to their original holes. It is not a good idea to restring historical instruments with new, oversized pins. If the tuning pins are loose in the pinblock, a simple shimming procedure can be used to restore tightness. *Never use pinblock restoring fluids*.

To shim the tuning pin holes, cut a piece of beech, walnut or ash veneer so that it is about one-quarter inch wide at the top and one-eighth inch wide at the bottom, with the grain running vertically. The length of the shim depends on the depth of the tuning pin hole. I make the shims so that they will stand about one-quarter inch out of the hole after the tuning pin has been leveled. The thickness of the shim also depends on the situation. I think it is better to have pins which are slightly loose rather than too tight. Low-tension fortepianos do not need excessively tight tuning pins. For the Bösendorfer, I used beech and walnut veneer .025" thick to shim the







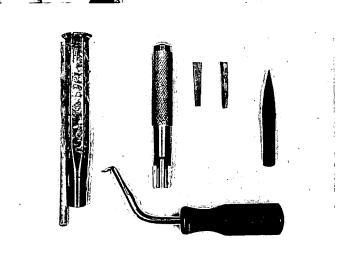


Figure 3 Figure 4

tuning pin holes. Each shim was slightly bent in the middle along the grain so that it would wrap around the hole. The shim was then inserted on the hitch-pin side of the pinblock as shown in illustration 2. Do not use glue on the shim as the tuning pin will wedge it tightly against the pinblock. (The shim is wider at the top than at the bottom for a good reason. Examination of old pinblocks shows that the pin hole is usually slightly wider at the top. The string tension pulls the tuning pin against the top of the hole making it slightly oval. This oval shape can be seen clearly in the middle hole of the unfinished unison in Illustration 2.)

Figure 1

After making the hitch pin loop in a length of new wire, measure the tuning pin end for accurate, uniform coils. Hitch the loop on the hitch pin, wind the coil on the tuning pin and tap the pin into a shimmed hole. The pinblock should be supported during this procedure. The original tuning pin height is transferred to a pin punch to which a 34 — February 1989 Piano Technicians Journal

maple dowel has been taped as a height gauge. The end of the dowel is covered with soft leather to prevent marring the face of the pinblock. (Illustration 3) After the tuning pin has been set in the shimmed hole, bend the top of the shim back with a narrow chisel. The shim will break off level with the top of the pinblock. It is best to trim the shim before before drawing the string up to tension and before installing another string. Make sure veneer fragments do not fall into adjacent holes.

Working with soft wire requires some special precautions because the wire is easily kinked and dented. Illustration 4 shows some special supplies used in stringing the Bösendorfer: a tuning pin punch with a depth gauge attached; a cut-away coil setter used to avoid denting or breaking the beckets; two veneer pinblock shims (the one on the right has been creased in preparation for installation in the pinblock); and a coil lifter. On the far right of the

photograph is an early 19th-century tuning mute (a tapered piece of rosewood covered with soft leather), which was found in the Bösendorfer's keybed during cleaning.

Shimming assures the conservation of the original pinblock and tuning pins. The shimming procedure can also be used on later instruments, particularly those with pinblocks which are mortised into the case walls. For laminated pinblocks it is often necessary to reglue loose laminations before shimming and restringing. Although shimming is time consuming, it takes less effort than a problematic pinblock replacement.

In summary, here is a step-by-step review of the measuring, cleaning, shimming and stringing procedures discussed above:

- 1. Measure the original tuning pin height above the pinblock.
- 2. Count and record the number of

coils on the tuning pin.

3. Count and record the number of braids in the hitch pin loop.

4. Remove, measure and save the original strings. Measure each string in several directions and record the average diameter.

5. If necessary, remove and clean each tuning pin, keeping the pins in order so that they are returned to their original holes.

 Clean understring leathers and textiles or replace them with material of the same color and thickness.

7. Clean the soundboard, bridges, bridge pins, nut, nut pins and pinblock face.

8. Experiment with pinblock veneer shims to find suitable material, thickness and width.

9. Cut and bend veneer shims.

10. Make looped strings with a special Renner looping machine.

11. Support the pinblock and restring using a tuning pin punch equipped with a depth gauge.

12. Set beckets.

13. Set coils. (Try not to dent or damage the beckets).

14. Set hitch pin loops on the hitch pins using a maple dowel.

15. Install string web of the same color and thickness and in the same location as the original. Often the original material can be cleaned and retained.

16. Chip the instrument to pitch with a guitar pick. (I match the pitch sounded by a Korg chromatic tuner while chipping. This is particularly helpful in keeping pitch orientation while chipping soft wire.

I am tuning the Bösendorfer to A=440. In my next article I will discuss what we know about pitch levels for pianos in the 18th and 19th centuries. Proof exists that A=440 was used, at least briefly, by some European piano makers as early as 1835.

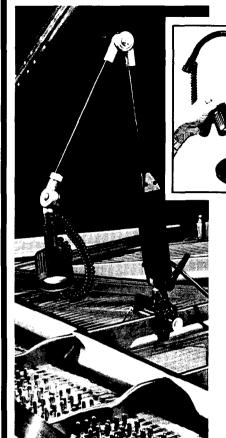
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ECONOMIC AFFAIRS

Are There Other Ways to Do This?

David Barr Economic Affairs Committee

Perhaps I'm not quite as bright as the next guy, or maybe I'm one of those people who has to learn everything at Hard Knocks University. Several years ago, I came to the bothersome conclusion that my income potential had a lid over it, and that I had just about reached that lid. The upper limit was governed by just a few key factors: time, energy, and my chosen rate. Of course, this is just common sense, but until I actually faced the problem, I never gave it much thought. This was a particularly disconcerting revelation since my type of personality does not like to feel limited or boxed in. I immediately began looking for solutions, including looking at other lines of work. After being self-employed for the last six or seven years, I found that I was not well suited to working for someone else, at least not in any of the positions available in which I had any qualifications. After speaking with some of these employers, I didn't feel quite so boxed in anymore, at least not emotionally. So, I have spent some considerable time looking at the possibilities.

One of the typical answers many businesses come up with when faced with the same set of conclusions I had drawn is to cut quality and increase quantity. It is considered a legitimate business decision in today's market place, but it did not appeal to me. I do realize that someone who is tuning eight pianos a day, five days a week, 50 weeks per year, who is charging \$40.00 a tuning is grossing \$80,0000 a year. Now, that last figure appeals to me, but the idea of tuning 2,000 pianos a year, frankly does not. I don't think I have that kind of stamina anymore, and I don't personally think that a quality job can be done in most instances in 30 minutes. There are several other time elements involved 36 — February 1989 Piano Technicians Journal in such a volume business as well. First of all, in order to hold the actual physical work day to eight or nine hours, every tuning would have to be completed in 40 minutes or under, a minimum of inhome customer relating would be necessary, and all appointments would have to be very carefully scheduled in close proximity. Next, the telephoning and paperwork would require at least another two hours per day. If the same person is performing both duties, the average work day is now between 10 and 11 hours long. There are those who thrive on this type of schedule, but the pressure and lack of family time don't add up to a good trade off for the additional income in my case.

So, if volume isn't the answer, what is? The third element mentioned earlier is my chosen rate. Let me start out on this delicate subject by clearly stating I am not advocating, nor will I advocate, that everyone should raise their rates or that any rate structure should be established. Not only would that be illegal, it

Several years ago, I came to the bothersome conclusion that my income potential had a lid over it, and that I had just about reached that lid. The upper limit was governed by just a few key factors: time, energy, and my chosen rate.

in needs, talent or the local marketplace. However, it is legal and appropriate to use figures for the basis of comparison without any suggested action stated. Basically, I'm going to tell you what I did and some of the things that happened. Several years ago, I decided I really did like what I was doing, but I wasn't making what I considered a living wage for the caliber of work I was doing. So, I raised my rate \$10 on January 1st of that year. Of course, that raised a few eyebrows. Whenever one of my repeat customers asked me about it, my reply was simply that I really wanted to find out if I could make a decent living as a piano service technician and if the public was willing to pay what I considered to be a fair wage for highly skilled work. If not, I would be seeking other employment in the near future. To be perfectly honest, I did lose some customers. Not entirely to my surprise, though, I gained almost as many customers as I lost. Most of my new customers were the kind of clients a service technician really wants. They seemed less concerned with price and most concerned with quality. Since my philosophy of doing business has always been to give my customers just a little more than what they are paying for, I have been pondering an appropriate system of raising my rates periodically commensurate with inflation and my increased skills. The two answers I am weighing at the present time are, first, a yearly percentage increase rounded to the nearest five dollar increment, and, second, a periodic lumpsum increase. I may use both systems, one for my regular in-home clients and the other for my larger contracts. I'm not really sure what I will do at this

does not allow for individual differences

point and time, but I do know that my rates will be going up soon. I would like to live as well as some other service business owners I know.

Rates aren't the final answer. If I want to earn \$80,000 this year and I set my rate at \$90.00 expecting to tune about 850 pianos or so, I suspect I might be in for a major let-down. Rates have to be justified and that is an individual matter. The elements of time and energy need more consideration. This is where management must take hold. In an earlier article (Organizing a Piano Service Business, Dec. 1987 Journal), I stated that if the average technician spent just six hours per week on the telephone 48 weeks per year, the accumulated time over a full year amounted to 7.240-hour work weeks. And if that same technician spent just a little over two hours per week over 48 weeks on general bookkeeping, the accumulated time over the same year was 100 hours or 2.5 40-hour work weeks. In combination, this amounts to virtually two and one half months of non-income producing time spent each year. Now, I realize that many of you do these tasks after your normal work time in your so-called "spare time," but my contention is that this is a poor use of time and energy in the managing of a business. If you have the time and energy to work those many extra hours in the first place, why not dedicate them to income producing tasks? Two and one half months of fulltime tuning at 20 pianos per week amounts to an additional 200 tunings. If my rate is \$50.00 per tuning, I could gross an additional \$10,000 in that same time. If I paid a part-time secretary/ bookkeeper \$5.00 per hour for the same two and one half month time span, he or she would only cost me \$2,000. I have often heard the statement that technicians feel they have more control of their businesses when they themselves do these tasks. If you hire competent help and train them correctly, you in truth will have far more control over your business. For instance, you could ask for weekly or bi-weekly financial statements. If you want control, you need that kind of information. I know that it is the rare piano technician who knows much about the financial well-being of businesses beyond the fact that they can afford to pay their bills and that taxes are going to hurt. What I am suggesting in all of this is that there are ways to manage your time and energies so that you may either make more income or have more time to spend with your families or on other activities.

I want to spend a little time on the next step. What do you do after you have all these management tools in place? Are we now stuck right back in the same box in which we started—with a built in income lid? Yes, unless you continue to work at the elements that can be controlled. For a good number of years I have been of the opinion that the one-man operation, under which many, if not most technicians operate, is almost impossible to control. The mandatory paperwork for taxes and customer records, the telephone work, the bench work (which is virtually impossible to avoid), maintenance of tools and equipment (including a vehicle), and the actual tuning of customer's pianos require so much energy and generate such confusion that little time is spent just thinking. One day it struck me that there was a role model available created by some of the smartest people out there (other than ourselves, of course). Doctors and lawyers came up with a thing called a practice some time ago. Now, in those practices, each doctor or lawyer still retains his or her identity and clientele, unless he or she is uanavailable for whatever reason. Each member of a practice becomes a partner in either a corporation or a legal partnership. They then own a percentage of the overhead of the business. This model struck me as the most practical next step. It made perfect sense to me that the overhead of operating a full service business could be shared by two or more technicians. Two technicians, for instance, could share the rent on a shop/showroom/ office. They could share the expense of one secretary/bookkeeper. They could share their expertise and reputations. They could divide management responsibilities. They could pool their tools and parts inventories. They could pool their financial resources for a larger line of credit in order to expand their individual operations. They could pool their time in order to tackle larger projects. They could relax knowing there is someone to fall back on when needed. The advantages kept adding up as I studied the possibilities. I tried to think out as many of the disadvantages as possible. There would be hundreds of details to work out. I would have to sacrifice some time from my normal incomeproducing activities in order to create such a possibility. There would be risks and added responsibilities involved.

There most certainly would be a clash of egos. Every business course or book I ever studied suggests that a good partner should be at least your equal, and he or she should not have all the same personality traits that you yourself have. There should be complementary and offsetting talents. A partner should have the same moral and ethical values you have. Both partners need to be patient and forgiving. Such a person is not easy to find (or be). I was fortunate.

My partner is Timothy T. Anderson, RTT. The longer I have gotten to know him and work with him, the more I am sure that it would have been almost impossible to find someone who offset and complimented my own talents more ideally. He believes in the same senses of honesty and integrity on which I have built my business. He is very talented and hard-working. Now, just to set the record straight, this merging into a practice has not been easy and smooth. We both have strong opinions and are used to doing things our own ways. I know of many an occasion we have been more than a little "steamed" at each other. I like to feel like I am the leader. Tim won't have any part of that. We have had to learn to compromise quite often. We have established a policy between us that says that either one of us has power of veto over any business decision. This is a strong statement of the trust we have developed in each other's skill and wisdom, and our own fallacies. Tim has a whole set of business skills and knowledge that I don't and vice versa. I am positive that I am a better business person now that we have to compromise our way to a final decision. Tim keeps me on my toes. I'm sure I do the same with him. These are some of the important intangibles. I also get to share ideas and experiences with someone who equally understands on a regular basis.

Tim and I created our new business about eight months ago. We are still knee deep in business paperwork and do not anticipate completing even the finished bookkeeping system, partnership papers, and business plans for several more months. We have just recently retained professional help in these areas after listening to a great deal of advice and counseling. It isn't easy. I am sure that I can speak for Tim and myself in saying that we both feel much better about our future potential in this business. In the short time we have been together, we have already seen both February 1989 Piano Technicians Journal — 37 tangible and intangible benefits to what we are doing. Our incomes are definitely going up, and our technical and business skills are developing even more rapidly than before. I suppose that you can tell by now that I am quite enthusiastic about this new venture.

It will be several years before I will be able to share any meaningful figures with you. Without long term figures, I won't claim anything other than short term success, even though I can easily state that this has been a very satisfying experiment. In a very small sense, it represents one of the most fundamental principles found in the Piano Technicians Guild—the principle of sharing. I envision that someday our entire industry might focus on a centralizing theme, that there is more benefit today than ever before to playing the piano. Per-

haps in this sense of a shared cause, all the facets of our factioned industry can draw together. In my own little way, I am trying to reunite our great industry. I hope we all can use our imaginations to find new answers. We can all benefit if we do!

■



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Are we having fun yet?

There are a great many areas and attractions in the metropolitan Portland area to keep the non-technical members of the family interested and entertained while the Guild member attends classes at the 32nd Annual Convention this coming summer.

Perhaps one of the best science museums in the country can be found in the West Hills area not far from downtown. The Oregon Museum of Science and Industry (OMSI) houses many marvelous "hands on" types of science exhibits covering all sorts of topics. There are daily shows in the planetarium, and the museum acts as host to an almost continual parade of exhibits on loan from other museums.

Adjacent to the OMSI itself is the Western Forestry Center which boasts a talking tree, a forest fire exhibit and intriguing models of sawmills and paper plants. Since so much of the Oregon economy is based on the timber industry, a visit to the Forestry Center can be very educational. (I realize that word is a no-no, especially in the summer, but at the Center it's absolutely painless!)

After a long afternoon of walking around the downtown area, kick off your shoes, peel off your socks, roll up your pant legs and wade around in the Forecourt Fountain located across the street form the center city's Civic Auditorium. Also referred to as the People's Fountain and Ira's Fountain (after the late

President's Message

The early arrival of the Directory for January 1989 delighted to no end my husband and several other members of the Guild who chanced to visit with us or phone us over the holidays. I expect that my copy may arrive in our mail box in a couple of days. At one point I managed to get a look at it and was most pleased with the articles on Portland, Oregon where our 1989 Convention will be held in July '89. As soon as any of our Auxiliary readers can handle a copy of the Directory, be sure to read Ben McKlveen's piece, "Follow the Oregon Trail" and also Taylor MacKinnon's "Portland-The City of Roses." In subsequent months we will have articles about the Pacific Northwest and accounts of some of the pioneers who played a significant role in the progress and development of the state of Oregon, the first state to grant women's suffrage!

In our December issue there was an article titled "Convention (Holiday) Comfort." We regret that in preparing the copy for the printer, the name of the author was omitted. Judy White, our Corresponding Secretary, wrote this article on stress. Any questions, comments, or additions to her topic may be sent to her directly in Alma Center, WI.

We are happy to provide in this issue another article on Portland prepared by Jennifer Reiter with a focus on what to do in the city with the non-technician and the young child. We enjoy all the copy from Jennifer, and would appreciate greatly any future articles by the folk in the Northwest. Details of classes. programs, and tour events will be provided in future issues of the journal.

Agnes Huether

tion hotel is located directly across the street from one of the largest shopping malls in the area. Lloyd Center boasts a very large year-round ice skating rink as its centerpiece and also offers a variety of interesting shops and smart boutiques.

Younger children will love a visit to the Children's Museum, located downtown on S.W. Second Avenue. The museum is crammed full of things to explore i.e. treehouses, a ceramic studio, marbles, pipes as well as many role-play areas such as a grocery store and a Zula Village.

A short drive from downtown, and along the same lines of "hands on" activity is the James Bybee House on Sauvie Island. The house was built in 1856 and the focus is on pioneer life.

No visit to Portland is complete without a visit to Washington Park and the International Rose Test Gardens. The parking area is a station stop for the narrowgauge railroad which delivers you to the the Zoo-OMSI area. The roses are an exquisite sight to behold with well over 400 varieties. It should be in full swing during the July dates of your convention.

I have just scratched the surface in describing some of the highlights which may be of interest to the members of the family who do not want to laze around the Olympicsize swimming pool at the Red Lion Inn during their entire visit to the "Rose City." I hope this thumbnail account

will serve to whet your appetite for a visit to the great Pacific Northwest.

Jennifer Reiter

Ira Keller who was a pillar of the Portland community), it is a great place to "soak your feet" and an unbeatable place for people watching.

As mentioned in a previous article, the official conven-

You all know our Julie Berry—former Auxiliary president, annual moderator of our Organizational Forum/Rap Session, former Production Assistant of the *PTGA Newsletter*, mother of Charlie and Danny Berry, wife of Guild president Ron Berry—thus, first lady of the Piano Technicians Guild. But, do you know "Madame," as she is known to the readers of the *Indianapolis Star*? Your editor was fortunate enough to obtain a copy of an article in the *Star* written by Mary Wade Atteberry about our Julie, and I am pleased to reprint the item in its entirety.

'Madame' Helps Pupils Enjoy French

Many people are intimidated by the idea of learning French, but to Julie Berry it's child's play.

As a teacher of French, Julie Berry has made learning a language synonymous with fun and games for hundreds of very young children during her five year tenure at Butler Unversity Preschool for Gifted and Talented.

The staff knows her as a creative and energetic teacher who can keep even a 21/2-year-old enthralled through a 20-minute lesson. The children know "madame" as the funny lady who will—with much ado—kiss spiders (rubber) if pupils can name all the animals on her cards, and who always seems to have a surprise or two in store when they walk into her classroom.

"My job is to let them discover that foreign language is fun," says Berry, who never envisioned herself as a preschool teacher when she graduated from Indiana University with a degree in French 17 years ago, but who now finds herself thoroughly hooked on pint-sized pupils.

Having two preschoolers (her 4-year-old Charlie is a pupil at the preschool) helps to keep her current on juvenile toys and characters, many of which find their way into her lessons.

Julie Berry meets with eight to 12 pupils for 20 minutes at a time, and no one needs to be coaxed into attendance. Eager children bound through her classroom door, calling, "Bonjour Madame!" and settle quickly on the rug.

"She is so wonderful. I just love coming up for French," says one of the teachers, Nancy Farrar.

In the course of a lesson, Madame delves often into her large bag of surprises, pulling out pop-up or wind-up toys, books, tapes and a very special doll to which the children love talking.

She asks them to guess—in French, of course—which object is inside a small pop-up pumpkin, the cat or the ghost. Their vote is mixed, and then she shows them. Then she asks about the second pumpkin and their vote is unanimous. She shows them that they are right. She then closes both pumpkins, sets them on the floor and hums a tune as she moves the pumpkins around to confuse them. Now which figure is in this pumpkin? They shout their answers!

Who cares about building vocabulary?

"If you are going to introduce foreign language to people early in life, you have to be very careful not to turn them off," she says. "We try to be silly. There's no reason for you to be serious."

"She ties in a lot of cultural aspects that I think make it meaningful for the children," says preschool director, Marge Fadely. "She has a fun, creative way—the children see it as an adventure."

Later, as they grow up, they will have this little kernel we've sown," says Berry.

And remembering Madame, may be they won't be afraid of studying foreign languages.

Thanks, Julie, for sharing this with us in your Christmas greeting. We really are most appreciative of the "Exchanges" we have received from you and Jennifer Reiter.

Editor

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