PIANO TECHNICIANS
# Journal
MARCH 1990

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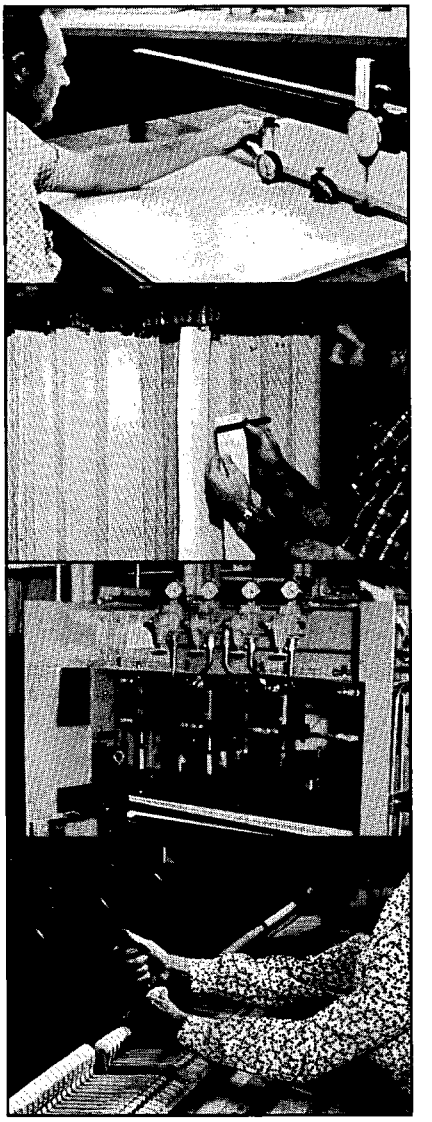

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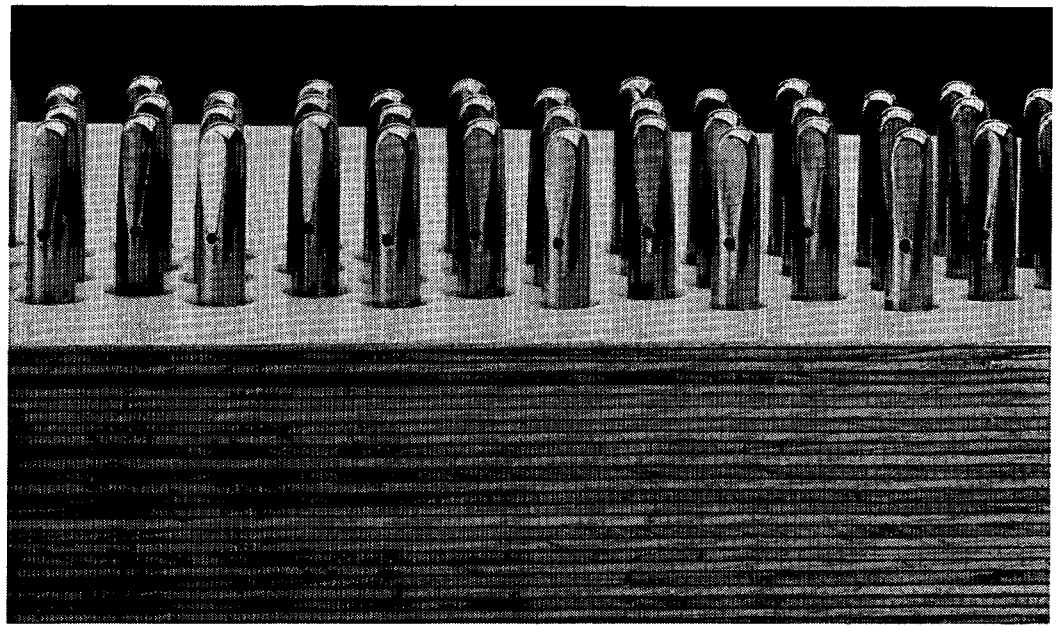

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PIANO TECHNICIANS
# Journal

MARCH 1990 — VOLUME 33, NUMBER 3 OFFICIAL PUBLICATION OF THE PIANO TECHNICIANS GUILD, INC.



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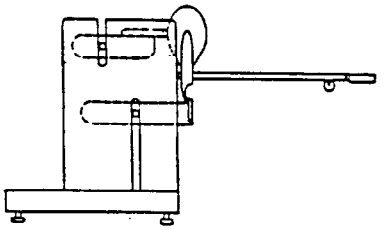

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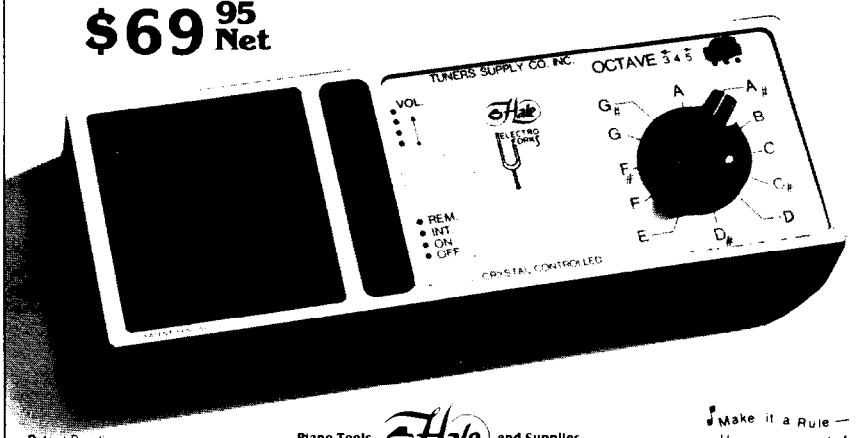


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## President's Message

# A Business Unlike Any Other

**Ronald L. Berry, RTT**
**President**

Recently there have been two major natural disasters in the United States. Hurricane Hugo did major damage to the Carolina coast, and the San Francisco earthquake was a constant source of TV news for a period of time. As news of these disasters reached PTG members, the way they reacted was wonderful to see. Obviously there was concern for our fellow members to see if everyone was all right. In South Carolina there were a couple of members who sustained a great deal of damage to home and shop. PTG being what it is, a relief fund was quickly established and many chapters and individuals gave financial support for those victims. Those in California seem to have sustained nothing more than the inconvenience of cleanup of shops, minor damage, and some severely messed-up commuting routes. Of course, there were the interesting stories of things like the grand piano still in its place but the rug underneath it found in the next room.

The reaction of our members to other members in disasters has always been heartwarming. Years ago one of my chapter's members had a flood in her shop which caused a fair amount of damage. Several chapter members, who are of course "competitors," offered to do work both in the shop and by donating tunings to help out. Another chapter member and I have used each other for "sick days" doing each other's tunings that can't be postponed when we have become too sick to do them.

We are lucky to have the camaraderie of such a group of people and to be in a business where competition is not so stiff that it turns us against each other. One reason we don't really interfere with each other is that if we are doing our job well, we have our own clientele which is loyal to us. Since a great proportion of our business is repeat business, other technicians' activities don't affect us much. Here's to many more years of a business unlike any other!


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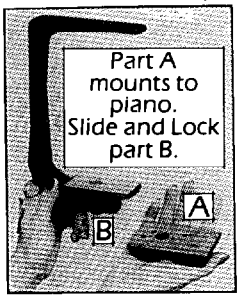


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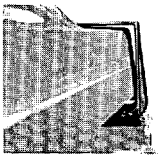

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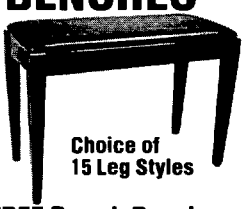

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## FROM THE HOME OFFICE

# Changes

**Larry Goldsmith**
**Executive Director**

In the life of any organization, there are peaks and valleys. The organization moves by fits and starts, now surging forward, now lapsing into relative stagnation. People change, technology changes, the economy changes — and organizations change.

Particularly in times of technological advancement or social upheaval, there are periods of controversy and discussion, intense questioning, restructuring and redefining of roles in society. There are also periods of relative quiet and consolidation. Both parts of the cycle are necessary — we move ahead, find workable formulas and systems, use them until they become outmoded, and then repeat the cycle.

When the Piano Technicians Guild was formed 33 years ago, it was already a mature organization in many ways. The two organizations that merged to become the Guild had already been in existence for many years. During this time, there have been many changes. The organization was founded to answer a need and, as needs changed, the organization reinvented itself to meet them.

As a society, we're currently in the midst of a time of upheaval, not so much domestically but in terms of world events. Six months ago, the recent developments in Europe would have seemed fantastic, if not impossible. And now President Bush claims his once-a-day briefings aren't sufficient to keep him up to speed on the latest news.

That's why the upcoming membership survey (see this month's *Update*) is particularly important. Before an organization can adapt to its members' needs, it must identify them. We have to build an accurate statistical picture of our membership in order to intelligently discuss changes in our programs and new offerings. This survey will give us that information. Your input is urgently needed.

We also need your involvement. Throughout the history of the Guild, there have been countless times where one individual has been vital to the organization's advancement. More than most groups, ours is a history of individual achievement. Our most honored members are those who have not been afraid to speak out and to work hard for their beliefs. It's easy to see that, with only 3,800 members, one voice can indeed be heard. By participating in your chapter, staying informed, and making the effort to keep this an active, forward-looking organization, you can help shape an entire industry!

***

From Charlotte, NC, Bill Clayton points out an error in my January column — technically speaking, we are not beginning a new decade, but beginning the last year of the old one. However, it's difficult not to get excited when our odometers click over once more in the "tens" column.

Bill's point was that we must constantly battle against misinformation in educating the public. "We must always strive to educate our customers as to proper piano care, and at the same time not offend those who have accepted misinformation as fact," he wrote in the Charlotte Chapter Newsletter. If my column encouraged anyone to take the time to evaluate his or her position, and if Bill's made us re-examine some of the things we take for granted, then we've both achieved our goals.

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See us at the **Pacific Northwest Convention**, Spokane, WA, April 3-5; **The New England/Eastern Canada Regional**, Québec, Canada, April 26-29; and the **33rd Annual PTG Technical Institute**, Dallas, TX, July 7-11.

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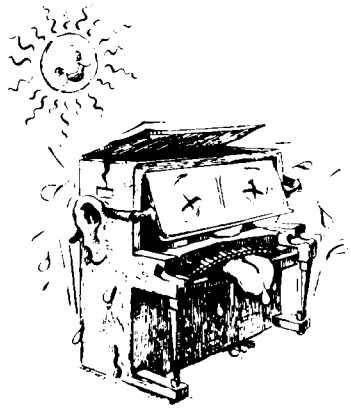

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# PTG's Texas Roundup...

## *The Tunable Concert Hall*

The most recently completed structure in the Dallas Arts District is the Morton H. Meyerson Symphony Center. It was designed by I.M. Pei and Partners in 1981. Ground was broken in September of 1985 and the work completed for the most part in September of 1989. The final price tag of the center itself is $81.5 million. With the land and the underground parking garage added, the total comes to $108 million. Its basic plan is a combination of overlapping geometric forms. The concert room called the Eugene McDermott Concert Room is named after the late founder of Texas Instruments. This orchestral room is the result of close collaboration between Pei and Russell Johnson, the acoustician of Artec Consultants in New York. The seating capacity is 2,065. The basic shape of the hall is that of a shoebox which allows for a sense of intimacy between audience and orchestra. It also allows for good lateral transfer of sound which is aided by thick walls. Besides the main floor one can also sit in one of four tiers and there is also seating behind the orchestra.

This hall is different from many in that it can be tuned. There is a 42-ton sound canopy along with three smaller flanking canopies that are state-of-the-art devices that enhance the sound of the room. They can be raised and lowered about 35 feet to within seven feet of the 80-foot high ceiling. A lower setting allows the orchestra to hear themselves better. A higher setting will be used for organ concerts when the Fisk Pipe Organ is installed in 1992. The appearance of the canopy reminds one of the spaceship from the movie "Close Encounters," landing lights included. There are hollow spaces beneath the cello and basses to improve the warmth of tone. The walls are made of plaster, concrete and wood without air pockets. There is also a cavernous reverberation chamber. The chamber wraps around the hall's three walls and is just below the ceiling. It has 72 concrete doors, each being four inches thick. When they are opened or closed, they can lengthen or shorten the hall's echo.

The reviews of the acoustics of the hall have been mostly favorable, and some say it has the potential to become a great hall. Johnson admits that he expects it to take at least two years before a final opinion can be formed. However, this hall is already a tremendous improvement over the Dallas Symphony's previous home; one can finally hear intricacies and nuances that before went unnoticed. The fact that the season is sold out speaks for itself.

It's possible that a tour may be available some time during the week of our convention, or perhaps some sort of concert. The symphony is not playing that week, however. If you do not manage to get inside the Meyerson, the nearby Dallas Museum of Art is well worth a visit. Various forms of transportation are available to the Arts District.

*Fred Yonley*
*Dallas Chapter*

## *Sights Of The Lone Star State*

It has often been said that Texas is a state of mind. Texans have a passionate love for this, the only state in the U.S. that was once an independent republic. Texans have somehow never gotten over their feelings of nationalism, but it is easy to see why when touring this state of geographic beauty with its plains, mountains, rivers and beaches.

Some conventioneers may want to venture into other areas of the state, but be prepared to cover some distance since Texas is larger than many entire countries (when standing in Texarkana, one is closer to Chicago than El Paso). Here is a sampling of places to see from around the state.

Southwest of Dallas is Dinosaur Valley State Park, located in Glen Rose. Here is one of the world's best reminders of an age when dinosaurs roamed the earth. 100 million-year-old Acrocanthosaurus and Pleurocoelus tracks remain in almost perfect condition. Giant man-made replicas of dinosaurs are on display. There's also camping, hiking, nature trails, swimming, and fishing. (214) 897-4588/ P.O. Box 396, Glen Rose, Texas 76043.

While most people think of Texas as a vast prairie, few realize it is the home of the Davis Mountains in west Texas. This region is sparsely inhabited, but rich in unadulterated natural scenery. Big Bend State Park is located in the bottom part of the southwest quadrant and is bordered for 107 miles by the Rio Grande. There is plenty of camping, hiking, river rafting, and rugged outdoors, complete with lots of wildlife, cactuses and rock formations. (915) 477-2251/Big Bend National Park, Texas 79834.

North of Big Bend is a little town called Marfa. Marfa is permanent home of the Chinati Foundation and art museum located at the old Fort D.A. Russell. Works by artist Donald Judd are located in and around the Barracks.

# ...Let Us Put Our Brand On You

## *Dallas 1990*

Our 1990 convention hotel, the Hyatt Regency Dallas at Reunion, has a unique classroom layout on the second floor which can really accommodate a new concept for our PTG institute. At past conventions we have had one-to-one tutoring for an extra fee; however, this year we will be offering hands-on workshop classes at no extra charge. These workshops will be limited to 20 people and will be the grand and vertical regulation classes which will accommodate up to 40 people per class. Obviously we cannot supply all the tools for these workshops, so if you really want to do hands-on you will need to bring some of your own tools. Don't forget your tuning tools because there will be a tuning class every period by some of the best technicians in the piano trade. There will be hammer installation, voicing, tool sharpening, bridge notching, grand and vertical regulation, etc. Most workshop classes will run for one period, but there are a few that will run for two periods and one class will be continuing through all four periods. Some subjects will be repeated with different instructors. We will have the workshop schedule and the tools needed for each class in a later issue of the *Journal*. If you don't have some of the tools needed for a workshop class like a voicing tool, some type of regulation tool or whatever, the piano suppliers at the exhibit area will be there to help you out.

The Roundup of instructors is complete so "Y'all" plan on coming to Dallas in July for a *Texas*-size PTG Annual Convention!

*Dick Bittinger, Institute Director, 1990*

*continued from previous page*

Judd is famous for his works made of milled aluminum and also concrete. Another Chinati building downtown displays sculptures by John Chamberlain formed from old car bodies, wrapped and folded together in amalgamations of color and chrome. (915) 729-4362.

Marfa is most famous for the mysterious Marfa Lights. These strange ghost lights appear at night on Mitchell Flat just off the highway to Alpine. This natural phenomenon has been studied scientifically, but still remains inexplicable.

On the other extreme of the state lies east Texas where gentle rolling hills and pine forests cover the terrain. The Texas State Railroad which runs between Rusk and Palestine is worth checking out. A vintage steam engine clangs and whistles as it pulls restored coaches through woods, pastures, and across streams. Reservations are a good idea for this popular attraction. (214) 683-2561.

Farther north lies Caddo Lake near historic Jefferson, Texas. This misty body of water, named for the Caddo Indians, hangs heavy with moss-covered Cypress trees. The Possum Kingdom State Recreation Area nearby offers camping, RV parking, cabins, paddle boat and canoe rentals, fishing, playgrounds, lodging, and restaurants. (214) 549-1803. Be sure to visit Jefferson, with its bed and breakfast inns. The Hale House is one such establishment. It is here that author Alex Haley does much of his writing.

For those who prefer sea breezes, Galveston offers island adventure. Galveston is located on the Gulf of Mexico with plenty of public beaches. Stewart Beach Park is the nicest beach, with its playground. Seawall Boulevard, which follows the Gulf, is lined with restaurants and hotels. The Strand is the old financial and commercial shipping district located on the back side of the island. It has been restored to house restaurants, specialty shops, and art galleries. A trolley runs from the Gulf to the Strand. Check out the Elissa, a recently renovated 19th century tall ship which is open to the public. Nearby, the Railroad Museum displays many old locomotive engines and cars and the Dinner on the Diner restaurant.

While in Texas, you will want to get out and visit this exciting state. You'll see why so many Texans still think of their state as a country within a country.

*Kerry Symes*
*Dallas Chapter*

*Big Bend State Park with a view of the Rio Grande*

# Disability Insurance

Janet Leary
Cleveland Chapter

As a rule, I am hesitant of spending too large a portion of wages on insurance. Nowadays, however, everyone feels they should have some sort of a health plan. Auto insurance is either state-mandated or considered a necessity. Life insurance is usually next on your insurance shopping list, followed by homeowners or renters insurance. Many of us forget to consider another important form of insurance — *disability.*

Of all the forms of insurance listed above, many experts consider disability to be the most important. Why? Your ability to produce an income is your greatest asset. Disability insurance is income replacement insurance. It provides you with a means to cover much of your family's expenses when you are absolutely not able to work. Statistically the chances are much greater that you will be totally disabled for some time before you turn 65 than you will die before that age. In fact, at age 35, you have a 45 percent chance of being disabled for 90 days or more before reaching 65. At age 55 you have a 26 percent chance of becoming disabled; and at age 55, 40 percent of those who become disabled are disabled for life.[1]

## The Development Of Disability Insurance

In the 1950s long-term disability plans were available to middle and upper income employees on a salary. In the '60s and '70s these plans became available to lower income and hourly wage workers. Why? There was a growing concern about the inadequacy of state workers' compensation plans. Also in 1956 the Federal government acknowledged their constituents' concern and extended Social Security to include disability benefits. This heightened interest in disability plans to the point where more than 22 million people had long-term disability protection in 1984. Of this number, 17.3 million were under group plans, and 5.5 million had individual policies.[2]

## How Much Disability Insurance Will You Need?

First of all, you'll have to determine what your living expenses are. Subtract all forms of income you will receive such as investments or Social Security payments. Even though Social Security or Workers Compensation may be provided, be aware that it's a struggle to receive and qualify for Social Security benefits.

To be eligible to receive Social Security disability benefits your physician must declare that you will be out of employment in "any gainful occupation" for more than a year. The Social Security administration then institutes a five-month waiting period. So, if you become disabled sometime in December, five months of wait expires in May. You then are eligible for disability in June with your first check arriving in July.

All my reading material suggests that Social Security only replaces about 15 percent of your average monthly income. A call to your local Social Security office will give you even less information. The amount of disability insurance you're qualified to receive is tagged to the amount of income you declare each year. They have separate qualifications for those under 30 and over 30 years old. The person I spoke to at the Social Security office made it very clear that you must not count on these benefits and simply would not even attempt to estimate an approximate percentage one may receive, since she claimed every situation is so different. Workers Compensation, on the other hand, generally takes a good year to provide benefits, often necessitating borrowing money to survive until benefits are paid out for those not prepared.

## Individual Disability Policies

Individual disability policies from insurance companies generally provide you with a policy that replaces an agreed upon portion of your average monthly income — usually 60 to 70 percent. They won't take your word for your income level, but instead like to see proof, such as tax returns. The reason for a benefit substantially below your normal wages is that they believe there is no incentive to get off disablility if the situation is too comfortable.

When computing your monthly expenses, list your present expenses in one column and then create a second column for expenses during a disability. If you're really thinking this through, you'll find differences in expenses. For instance, piano technicians generally "burn out" autos with all their driving. If you are disabled, your auto and clothing expenses will be less, but your medical expenses will be more. If your disability will not allow you to continue servicing pianos, you may find a need to increase educational expenses to train for another occupation. Take your time and think this through before applying for insurance. You want to direct your agent to serve your needs instead of blindly signing up for a policy that's deficient. Why? Many policies don't give you the option to increase coverage at a later date, and the policies that allow coverage increases also charge a premium for this added option.

## What To Look For In A Disability Policy

There are two types of disability insurance — short-term and long-term

coverage. Short-term generally provides coverage for up to two years (in private plans), while long-term provides benefits for the employee's lifetime.

Short-term coverage is really a type of "sick leave" coverage. In the corporate setting it is a continuation of full income for a short period of time, provided for through operating funds of the corporation, and is generally limited to a set number of days per year. If the disability or sickness extends beyond the set "sick leave" period, sickness and accident insurance kicks in, providing less than full pay for the employee.

As self-employed individuals, when we try to purchase disability insurance the plans lump together short-term and long-term benefits in one policy. The more short-term benefits you desire, the higher the premium. Another point to keep in mind (especially if you already have a disability plan and are a female), is that in the past, rates were higher for women than men. Many companies are presently changing over to unisex rates. If your present policy, or the one you are considering has not changed over to unisex, inquire or look elsewhere.

## When Shopping For A Disability Policy, Ask For The Following:

1. "Guaranteed renewable" until age 65 or 70 no matter what your health or job is, and "lifetime coverage" as opposed to five or 10-year coverage.

2. Pays benefits if the disability is the result of an illness or injury.

3. Premium cannot be increased over the policy life. The jargon used to describe this option is "non-cancellable."

4. Check to see if the policy covers a partial disability. A partial disability rider supplements your income if, after you become disabled you take a lower paying job. Also be aware of each individual policy definition of disability. "Disability" can be defined in three ways:

1. Unable to perform your own occupation.

2. Unable to perform any occupation for which you are suited by experience or training.

3. Unable to perform any occupation at all.

If your policy defines disability as "unable to perform any occupation at all," you may not be entitled to benefits at all, or you may only collect the difference between your monthly policy claim amount and your new occupation's wages.

5. Be sure that the policy you are considering does not subtract unearned income, such as interest and dividends from your benefits payments. Unearned income is not salary or wages and should not be considered in the benefit formula. Read the policy carefully! A savings plan is very important to self-employed people, and excluding the amount you receive in interest income from your disability benefits is a costly mistake you must not make.

6. "Residual benefit" coverage. This means that you can collect a portion of disability benefits if your physician permits you to return to your present occupation on a part-time basis. If your policy has this rider, you could follow doctors' orders and work a half-day and still collect half of the insurance benefits. If the policy you're considering doesn't have this provision, you'll lose all benefit payments whenever you go back to work, even at a limited level. Additionally, some companies pay partial benefits — say 50 percent of your full benefit if you are partially disabled. Most of these partial benefits last only three to six months — this is not what you want! True residual benefits last as long as needed.

7. "Cost of living" or "COLA" rider. This provision protects you from inflationary pressures that could greatly diminish the purchasing power of your benefits over time.

8. "Waiting period" Disability policies are structured to begin paying benefits after a set period of time such as 30, 60, 90, or 120 days of disability. The shorter the wait period you stipulate in the policy, the higher your premiums will be.

Be aware that not all the companies offer all the provisions and riders mentioned above. If you can't find what you want with one company, shop elsewhere.

## How Can You Cut Premiums?

1. Lengthen the waiting period before benefits are paid. Create a savings plan to set aside 90, 180 or 360 days of personal funds so you can self-insure in the event of a disability. This will allow you to prolong the elimination period, and dramatically lower your premiums since insurance benefits will kick in for catastrophic disability only.

2. Another source of cash if you become disabled is your IRA or Keough plan. You can withdraw from either of these plans before the age of 59 1/2 without the 10 percent penalty if you can show that you'll be disabled for the foreseeable future. Now remember, your IRA plan was meant as a savings for your retirement. If it shrinks because of disability withdrawals, you have a financially poor retirement. To remedy this problem, fund your retirement plans to the maximum each year! If you amass a large retirement fund, you can make disability withdrawals simply from the interest generated on your IRA while keeping the principal intact.

3. Eliminating some of the special policy riders also cuts your premiums. But keep in mind that a weak policy is a basically worthless policy.

a. "Residual rider" raises premiums by 15 to 25 percent.

b. "COLA" raises your premium an additional 20 to 25 percent.

c. Stretching the elimination period from 30 to 60 days can save you nearly 20 percent.

4. Buying your policy when you're *young and healthy*. If the policy guarantees a level premium for the life of the policy, at a younger age you will be plugged into a lower premium level. As you age, the premium level will be higher, which means you'll be paying a higher annual premium per year. Don't forget to weigh the cost of money for those younger years when you weren't paying premiums and the premium payments you didn't give to an insurance company, as opposed to signing up at a young age and paying out all those premiums.

5. Shortening the period when benefits are paid. Instead of lifetime benefits you can choose a policy with benefits until age 65.

6. Cutting the amount of benefit paid to you. Instead of 70 percent of your income, you can self-insure opt for 50 percent.

## A General Comparison

The following chart shows comparisons of different riders and different companies. These rates are for a 40-year-old, non-smoking manager earn-

## Annual Policy Cost[3]

| *Insurer* | *90 Day Wait* | *30 Day Wait* | *90 Day Wait & Residual* | *90 Day Wait & COLA* | *Maximum Monthly Benefit* |
|---|---|---|---|---|---|
| Monarch Life | $903 | $1310 | $1115 | $1047 | $2350 |
| Northwestern Mutual | 977 | 1459 | 977 | 1239 | 2200 |
| Paul Revere | 823 | 1265 | 823 | 1010 | 2350 |
| Provident Life & Accident | 870 | 1386 | 1090 | 1078 | 2300 |
| Unum | 754 | 1251 | 903 | 980 | 2300 |

ing a $40,000 salary annually, and would pay $2200 a month (which is about 66 percent coverage) if the person could not work in his/her "own occupation" because of illness or injury. The benefits continue until age 65. The five companies in the accompanying table own 50 percent of the high-limit disability market. Each company tries to differentiate itself from others by creating a so-called basic plan with special benefits. This may confuse your decision-making.

The premiums listed in the chart are merely cost guidelines to get you in the ballpark. When picking a private plan, your age, occupation, income level and health will all have bearing on the kind and cost of protection you'll be able to purchase.

### What Will Your Insurance Underwriter Ask You?

Your insurance underwriter will ask you a battery of questions with the intention of determining if you qualify for coverage. They'll not only want to assess your occupational title, but also the type of duties you perform in that occupation. If you perform several tasks such as piano tuning, refinishing and rebuilding, the underwriter will choose the most hazardous task and classify you in that category.

The following is a general list of classifications: Class 4AS — select professionals and corporate executives; Class 4A — select professions such as actuaries, chemists, civil engineers, etc.; Class 3A — people engaged in mental work or office duties; Class 2A — supervisors, technicians, and those with special skills not generally described as manual labor (this is the category that piano tuners fall into); Class 2B — those who fall into 3A or 2A but don't fulfill minimum income requirements. As you can see, Class 2A is one of the lowest, which means you will be paying out more for coverage than the 40-year-old manager given as an example above.

In addition to proof of wages earned, they'll also want proof of your medical status. As is usually the case, insurance companies like healthy people, with healthy genetic backgrounds so they'll only have to collect your premium payments, not pay out claims.

Even though "piano tuners" are listed as a disability classification, insurers do not like to cover self-employed people with a business at their residence. The exception is someone with a well-established business at their residence such as an attorney, doctor or dentist, or those who substantially perform their occupational duties away from the residence. Those that fall into this exceptional category may only be offered a 60 or 90-day waiting period to protect the insurance company from following up on abusive claims.

The information in this article will be supplemented in the near future with an article on Workers Compensation. ≡

### Footnotes:

1. *Forbes*, December 12, 1988; "Your Disability Coverage May Have Gaps"; p. 264.

2. *Monthly Labor Review*, July 1989, "Employee Sponsored Long-Term Disability Insurance"; p. 16.

3. *Money*, February 1989; "Disability Insurance — Check That You Have The Coverage You Need Most"; p. 78.

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*Monthly Labor Review*, June 1989; "Analyzing Short-Term Disability Benefits"; p. 3.

*Working Women*, June 1988; "The Paycheck That Keeps Coming When You Can't Work"; p. 56.

*Changing Times*, May 1988; "What If You Can't Work?"; p. 56.

*Forbes*, December 12, 1988; "Your Disability Coverage May Have Gaps"; p. 264.

*Monthly Labor Review*, July 1989; "Employee Sponsored Long-Term Disability Insurance"; p.16.

*Money*, February 1989; "Disability Insurance — Check That You Have The Coverage You Need Most"; p. 78.

"Insurance, What Do You Need? How Much Is Enough?" by David Kennedy, Knight-Kidder Press, ©1987.



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## THE TECHNICAL FORUM

# NAMM Report 1990

**Susan Graham**
**Technical Editor**

The trend in the acoustic piano market is to consolidate. Manufacturers are focusing on the production of specific sizes and models which have demonstrated enduring popularity as wholesalers, buyers' groups and importers are balancing the cost of doing business by representing several names. The tone of the winter 1990 National Association of Music Merchants (NAMM) Show reflected this strategy of streamlining to stay competitive in today's entertainment market.

The companies which cater to the "serious" market — professional and performance use — seem to be the healthiest. Boesendorfer, for instance, was displaying their new 213cm (6'10") grand. This instrument incorporates some familiar Boesendorfer features such as the five-sided case and 92-note scale found in the 225. However, it utilizes duplex bars in the treble scaling, and has a closed-window pin panel (the pinblock is covered by the plate). The closed-window plate and duplex bars have also been added to the 290 Imperial Grand. As you may know, I do not find the NAMM show the best venue in which to judge pianos: carpeted floors, high ballroom ceilings, and ambient noise do not yield favorable acoustic conditions. However, the impression given by the new grand is that they put some of the "stuff" in: a more complex tone in the treble, accompanying the usual cleanness of sound throughout and the cello-like string quality of the tenor and bass. Dr. Roland Raedler, Managing Director, was available for discussion of the new piano, and also gave several formal presentations. It was interesting to hear him remark that up until three years ago, the United States was the biggest market for the Boesendorfer piano. That distinction now goes to Japan.

Bechstein was also displaying a new seven-foot grand, designed for them by Luther Thoma. It includes a redesigned action, made for the company by Renner (as are all their actions). Distribution of the Bechstein piano is now being handled by Schimmel.

Russell Kassman will continue to handle the Sauter line, featuring yet another grand in the seven-foot range: this one is 7'2". It features duplex scaling, also new for this company; the prototype has a Herrburger-Brooks action but the production models will use one made by Kluge.

It seems safe to assume that these makers have observed a trend in the market toward demand for the size of grand which, while it still fits in a home, offers the dynamic range and quality of sound more easily produced by larger instruments.

Once again, Renner was represented by Camilleri Pianoworks of New York. They are now offering a line of hammers made specifically for them. Renner-made hammers available previously have been production overruns made to varying specifications. Suppliers purchase these lots of hammers to distribute; since Renner makes about 450 different hammers, this has resulted in considerable variation in the "Renner" hammer. The hammers now available from Camilleri will be one consistent model. The grand sets feature a total of 96 hammers with 32 or 26 bass, mahogany or hornbeam moldings in lengths of 3 1/8" bass, 2 13/16" treble or 3 1/4" bass, 2 15/16" treble, all with unimpregnated felt. The size and number makes them quite versatile in accommodating a variety of action specifications. Upright hammers are also available in sets with hornbeam moldings, 32 bass, 64 treble, and an overall molding length of 2 11/16" bass, 2 15/16" treble. Price range is $215-235 in grands and $180-190 in verticals. Rick Baldassin will be doing classes on voicing these hammers. He mentioned an important but little-known fact about the Renner hammer gauge (used to measure angle of hammers when boring replacements). This gauge follows a system which divides a circle into 400° instead of 360°: numbers read off that gauge cannot be directly transferred onto some (most) domestic boring gauges. Either calculate the adjustment mathematically or "eyeball" to accommodate the difference.

Seiler displayed the usual range of grands and large verticals with the classic European sound and a variety of high-quality cabinet styles. They are building a new factory.

A new "face" at the show was Steingraber & Sohne. They are one of the oldest (established in 1852) and smallest piano manufacturers in Germany: total production is about 300 a year, with 20 percent being grands. They offer two sizes of grands on the American market. One is 5'4" and is so wide at the tail it appears almost square: this permits longer bass strings (increased area for overstringing) and more soundboard area. The result was an unusually good bass for an instrument this size. The other grand is 6'9". Focus here has been on making an action with a light downweight of 48-52 grams while keeping a 20-25 gram upweight. The smaller piano retails at approximately $24,000; the larger, $28,000.

Our usual contact at Schimmel, Leo Duricic, is recovering from throat surgery and was unable to attend (we wish him a speedy recovery). Albert Hattermann was one of two engineers present, and was very informative about some of the design processes Schimmel is now employing. His background is as a piano builder, but he has picked up the

necessary science and engineering knowledge along the way to become involved with design (and now also works with Hewlett-Packard). Schimmel has developed a machine which plays a piano action and measures the response. This enables them to objectively record such factors as touch and repetition in an active mode, rather than relying on static measurements (such as the use of gram weights) or subjective ones (pianists' comments). It also measures sound output, enabling them to design for maximum transfer of energy from the hammer to the string. Their computers can now simulate the results that various scale changes might produce, reducing the time needed to design a new scale from six months to one day. The 6'10" grand which they introduced last year has a new action; the aim was to match the feel of a Steinway B. It was typically "light," but offered more resistance at the point of let-off; a different feel for this maker, but a pleasant one.

Moving into the domestic makers, we find Kimball making most of its changes in the vertical lines. The new E series console is assembled entirely in Mexico. A Schwander action is being used in all consoles (replacing some use of Pratt-Win actions), with the Langer BP action in the studio. High-end consoles with solid spruce boards are being emphasized. The company also produces the Jasper American line, which includes a 43-inch console with a Schwander action. In grands, they continue to feature the Viennese Classic line in 5'2", 5'8", 6'7" and nine-foot lengths. With solid spruce boards and Herrburger-Brooks actions, these pianos do well to fill the need for midrange, good quality domestic instruments. They also continue production of the La Petite grand, using an improved Pratt-Win action.

Wurlitzer was showing a new five-foot grand. It is domestically made, has a Wurlitzer scale and a "multiradial" board (a laminated board in which the grain of the laminations cross at angles other than 90°). This piano will be available in late April or May; plans are to expand the line to a 5'8" and possibly a seven-foot model. The prototype on display had a light action with a pleasant feel, and surprisingly good bass for a piano this size although it was a little nasal in the tenor and thin in the top. It includes a true sostenuto (in these days of 20th century classical music this has become more important).

Wurlitzer also has nine new verticals: three styles in 37-inch, a 42-inch now with a laminated spruce board instead of basswood, and a 43-inch console with a solid spruce board. Presumably as part of further consolidation with Baldwin (which owns the company), final assembly is moving to Greenwood, MS, and the keymaking equipment is going to Trumann, AR.

Baldwin has also made some changes in their grand line. They will be discontinuing use of the Howard name on their second line grands. The C171 will now be designated the DH Baldwin: this piano uses a Baldwin scale, and is produced in a joint venture with Samick (as are all the Howard grands). The former DH Baldwin, made for the company by Yamaha, will be discontinued. The other two sizes of Howard will now be made under the Kranich and Bach label, a name the company acquired when it purchased Wurlitzer. To keep it all straight: any piano with the "Baldwin" name is domestically manufactured; pianos under other names coming from this company are made offshore, some with old scales, some with new.

The Hamilton is being made in more furniture styles (the 5000 series) including mahogany Chippendale and Queen Anne oak and cherry. The grands are available in an "Options" or custom finish line; the greatest demand is for the natural wood finishes with specialized trim.

Featured in the booth was the new Baldwin model B, a 4'10" grand which was one of Del Fandrich's major projects with the company. It has the same action as the M. The hitchpin design has been changed somewhat: this piano utilizes a machinists' part called a drivelock pin, which has an indentation or "waist" which provides a firm location for the wire. In the factory, the workers can set the height of the pin itself after the piano is strung; this employs the same principle as the original accu-just hitchpin, in which bearing can be set after the piano is assembled, but it is easier from a production standpoint since the wire stays in place on the pin during stringing. (Other Baldwin grands continue to use the accu-just system). The model B has a bass bridge with no apron, and a laminated board with the grain running at 60° to neighboring plies and radial ribs for greater flexibility. It is constructed with a separate inner and outer rim and has no posts, since the plate is heavy enough to provide the necessary strength. Unfortunately, the model on display was in need of action regulation and had some of the tonal shortcomings which seem to be inherent in a piano this size. Also inherent, apparently, is popularity, since the piano has been a good seller since its introduction in June. Retail is approximately $7,000.

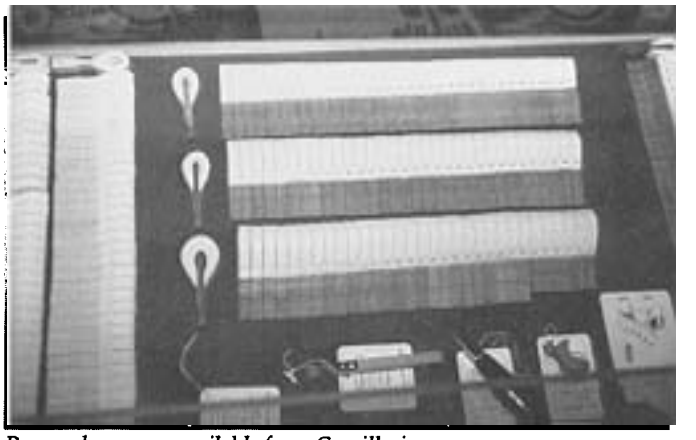
As is their custom, Steinway did not display in the show but representatives were on hand in a suite in a nearby hotel. Gary Green and Peter Goodrich presented details about the expansion of the New York concert staff, which is intended to enable them to offer concert preparation assistance to dealers outside of the New York City area "simply by calling us up." They have also expanded their record-keeping system so they can keep information on all Steinways used for concert work.

The Asian manufacturers were well represented. Young Chang was out in full force with a large display which included the 6'5" Lew Herwig-designed grand introduced last year, and a number of changes in the vertical line. These include a new 43-inch console with a full perimeter plate and backposts, and a larger soundboard area (accomplished by discontinuing use of cutoff bars in both this and the former 107 model). Alan Vincent is Director of Technical Services for this company.

The Weber name is now actually a division of Samsung America, with pianos made for them by Young Chang. This year they have rescaled 30 percent of their pianos, added a six-foot, one-inch grand and are including duplex scaling in all their grands except the 4'11 1/2". Grands also have solid spruce boards; the seven-foot has a Renner action.

The Schumann line includes products from a variety of sources. They carry three sizes of verticals, with the lower end being made by Jasper American and a European style as well as 45-inch and 46-inch consoles made by Samick. Samick also makes five sizes of grands for them, ranging from 4'7" to

*Duplex bars in the newly introduced 6'10" Boesendorfer*



*Renner hammers available from Camilleri*

*Steingraber & Sohne 5'4" grand*


*Kawai plexiglas GS40*

6'10". The 6'10" retails around $12,400.

Schafer & Sons and Sojin are now being distributed by the American International Buyers Association. To quote their press release, "AIBA purchases a large volume of pianos from manufacturers around the world, and then passes the savings on to its members in terms of better pricing and promotional support."

In view of the recent political developments in China, it was good to see the representatives from the Guangzhou Piano Manufacturer (formerly Pearl River). This company still makes only verticals, imported by Westbrook under the Brentwood name, and still includes Bud Corey on their staff of consultants.

Speaking of branching out from a Wurlitzer background, Richard Elrod is the new technical service manager for Samick. The company is now assembling 43-inch verticals in California (oak, cherry and walnut finishes). They have also introduced a 45 1/2" studio in an oak finish to the American market.

Kawai puts out a large display, featuring their electronic line (which is rapidly gaining in popularity) along with the acoustics. The velocity sensors in the MIDI grands (5'10 KG2 and 6'9" GS60) have been improved so they are no longer a noticeable part of the touch. A number of changes have occurred in the vertical line: the 501/601 line has a new cabinet style and leaded keys and is now the 502/602 (42-inch consoles). The new CEll is a eurostyle 44-inch console; the CSll is the same piano with legs. The company has retained Dr. George Shaw, formerly of Long Beach City College, to serve as Director of the Kawai Music Education Center. The display featured the plexiglas GS40, and the newly redesigned concert grand introduced last year, which technician Brian DeTar sold off the floor at the show to Brian Wilson of Beach Boys fame.

Kawai continues to manufacture pianos under the Schiedmayer name, dropping the use of Diapason and making the pianos according to original Schiedmayer scales (a six-foot grand and three styles of studio-style verticals).

Yamaha also had a large display including electronic and band instruments along with their acoustic pianos. The most significant change apparent was the introduction of the disklavier system in a console (it has the key sensors only, without the additional hammer sensors found in the studio and grand models).

Performance Pianos, a Houston based company which imports the East German-based August Foerster line, is looking forward to the improved communications and trade status resulting from the recent political changes. New owner, in partnership with Wilda Fallis, is Mr. Russ Lindquist, who explained that such things as the use of FAX, which we take for granted, have only just become available to them in dealing with the factory. They were displaying a new 116cm. vertical, which featured rather interesting "counterbridges"—reinforcing blocks attached through the back of the soundboard to the bridge. Tone was very balanced in this instrument throughout the scale, although the action had a somewhat spongy feel which seemed to be the result of minor regulation problems.

The Classic Piano Company has been manufacturing player pianos on purchased Hamilton strung backs, both

under their own name and as private label for Baldwin and Wurlitzer. They now have their own 45-inch back, designed for them by Rick Wheeler. They are branching into production of a non-player 40-inch console, hoping to fill the need for a domestically-made console in a reasonable price range and quality (it will wholesale around $1,195).

As a break from all these pianos, I enjoyed seeing the "monkey organs," newly on the market from the Deleika company in Germany. These are crank-operated pneumatic player devices — a little strident for the home, perhaps, but in charming cases of traditional design.

Well, what does all this say about the acoustic piano market? There's no denying that it isn't the business it used to be: competition for entertainment time and money is fierce, and we have become a culture of people who want gratification more quickly than can be had in study of a demanding instrument such as the piano. Economic realities such as the cost of production and the inroads made by electronic instruments seem to be turning the piano into a carriage trade item. This is not necessarily a situation which will hurt piano technicians — the people who want pianos want them to be right: they make an investment, and they maintain their instruments. Interest in used and rebuilt instruments is strong. What the new-piano market situation may mean is less reliance on manufacturers for warranty and technical assistance as it becomes increasingly difficult for them to maintain in-house technical staff, and as more and more of the pianos on the market are from offshore sources. We technicians may simply have to be more self-sufficient and able to adapt to these changes without spreading panic and doom among our customers. We owe it to our colleagues in manufacturing and sales, as well as to the future of our own businesses and of the instrument we love, to promote and encourage piano playing as the organic and wonderful thing it still is.

## And Now For A Few Technical Tidbits...

(All this marketing sure makes me want to go fix something...) Newsletter reprints: From *7/0 Pin*, Baltimore, MD, Chapter — *"Walter White has kindly contributed this item for our clicks and buzzes compendium. Symptom: a slight click when a certain key on a five-year-old grand is played. Remedy: Pulled action out and the same key now sounds normal. Operating damper underlever for said key with finger (simulating key travel) brings back the click. Examining the underlever reveals one of its lead weights loose in the wood. Apply spot of glue on each side around the lead, reinstall the action and the click is gone — Eureka! (Another way would be to crimp the lead from the side with hammerhead removing pliers. — editor.)"*

From *The Valley Technician*, Sacramento, CA, Chapter — *"Portable String Height Gauge (Taken from Mark Anderson's technical program) A handy "let-off rack" for grand regulating can be made using two pieces of coat hanger wire and some small elastic thread from a fabric store. Screw the wires to each end of the action using the end rear action bracket screws and stretch the cord between them. Bend wires to align fore and aft and slide elastic up or down on wires to set height for each section. — Bill Spurlock*

*Our technical featured two special guests from the San Francisco Chapter, Mark Anderson and Margie Williams, who presented a two-part program. Margie demonstrated a method of removing broken-off shanks from upright hammers and butts using a drywall screw as a puller. First the glue collar is chipped off and a drop of wallpaper remover-water solution is applied to the glue joint to begin soaking. Next any protruding shank is clipped off flush and a punch mark made in the broken shank using an awl. Using a number 39 drill in a pin vise, a hole is drilled in the shank part (5/8" deep for butt, 5/16" for hammer) and more soaking solution put into the hole. A two-inch number six drywall screw (with the point ground off) is then screwed into the hole and heated with a heatgun or flame. The heat travels down into the shank, softening the glue joint. A plier or screw type shank extractor is then used against the head of the drywall screw to pull out the broken shank. This method preserves the original hole and therefore parts alignment is assured when the replacement shank is installed.*

## ...And Some Comments:

*Susan:*

*In reference to the October issue of the* Journal *in regards to the Foredom Tool, I would like to point out that the Dremel Moto-Tool should not be slighted.*

*The Dremel Moto-Tool has been around for a couple of decades that I know of and has always maintained a high degree of quality. Availability is very good along with a wide range of accessories and attachments which include: flexible shaft, drill press, router, combination belt/disc sander, speed control unit, table saw, lathe, Scroll saw, and an unlimited array of bits and cutting tools. Also, an excellent manual (guide) to the equipment and its variable uses. The manual alone is a valuable asset.*

Gerald Foye, RTT
San Diego Chapter

*Dear Susan:*

*After reading Bob Bayley's recipe for an epoxy injector, I had to write. Somehow the idea of drilling through a bridge pin doesn't appeal much to me. For some years now, I have used disposable syringes and needles to "inject" epoxy into bridge pin holes. When bought in quantity (either from a medical supply or a feed store, where they are usually cheaper) they are very inexpensive, and throwing them away is the easiest clean-up there is. I buy 12cc syringes and 16 by one-inch needles, and it usually takes me about 8cc of epoxy to do a bass bridge. Major precaution: make sure the needle is well-attached to the syringe! Otherwise you'll find out why I always have a roll of paper towels handy.*

David J. Stocker, RTT
Puget Sound Chapter

*Dear Ms. Graham:*

*I can't help but comment on the item in the August* Journal *issue about the Bauer piano, submitted by Kent Gallaway. This is the grand built by that great experimenter, William Bauer.*

*I, too, have one of these, and the lack of a heavy wooden frame makes for a wonderful arrangement for the inclusion of the Welte Mignon (Licensee) reproducing action. Not only was it obviously of great benefit in having so much freedom when the equipment was installed back around 1923, but in rebuilding and servicing it there's all sorts of room in which to work. I wonder if Bauer himself foresaw this advantage!*

*Another fascinating feature of this instrument, which shows in the picture but which is not discussed, is the "double-ribbed sounding board" with ribs on both top and bottom. I've been told that soundboard cracks are virtually unheard of in a Bauer grand built this way.*

*I wonder if someone can explain to me why the old Mason-Hamlin screw-stringer arrangement isn't 20 times better than having a pinblock, from a technical stand-*

*Deleika "monkey organ" works*


*Charles Walter studios*

*Muzelle players*


*And, of course, our old friend Roscoe*

*point. I've often raised this question with competent technicians, and have never really had a satisfactory answer other than the typical conservatism of the industry.*

Harvey Roehl, RTT
Southern Tier, NY Chapter

*Dear Susan:*

*Well, I'm going to rise to the bait, even though I* really *don't have time right now. I just can't leave the recent letters on repetition problems in new Steinways unanswered, so here goes.*

*There has been some discussion in the last couple of issues of the* Journal *regarding repetition problems in new Steinway grands, especially B's and D's. It has been rather puzzling to me, because, though I have had several such problems, I have so far been able to take care of them without resorting to such drastic measures as redesigning action parts. Of course, I am not familiar with any of the individual pianos discussed, so I cannot speak directly to their individual problems.*

*The anonymous response to Ken Sloane's article brought into focus what bothered me about the latter. Both authors have made insightful comments on action characteristics that promote good repetition. But it seems to me both authors have failed to consider the importance of good center pinning. We all agree, I think, that hammer centers must be "free and firm," to quote the Steinway "specifications." The exact numbers that are ideal vary a little from one type of center to another (Renner, Tokiwa, etc.) and from one season to another, but there should be some friction, and there should be the same amount in all hammer centers.*

*But what about jack centers? The anonymous response mentions jack centers with eight to 10 grams of friction. To me that will just about guarantee repetition problems. I have, indeed, run into whole sets of Renner wippens with tight jack centers, especially two to three years ago.*

*A more subtle matter I hear discussed only rarely is in the repetition lever centers. It has been my experience that they have to be farther from ideal to create an obvious problem. However, I think proper pinning here is much more important than in the jacks. A jack center has to be awfully loose before it creates serious problems, at least in the short run. A loose repetition center, however, makes spring adjustment very difficult, and results in weak springs. This is exacerbated by loose hammer centers. The result of weak springs can be, as is so aptly pointed out in the anonymous response, poor jack return. Having loose centers can cause another "repetition problem": poor checking, especially in soft playing. Having enough friction in the centers seems to give the backcheck a much better chance to grab the tail. (The buckskin must be in good condition, of course.)*

*So I would argue that before performing major surgery on the hammer tails, and before replacing repetition springs, we should at least consider whether all the action centers are properly pinned. When this* is *the case, regulation is much easier, and action function is much better.*

*I'm not sure I want to start bringing athletic jargon into our lexicon, but it seems we too often gloss over the fundamentals of our business. Center pinning is just as important to good piano work as bedding the keyframe. Without either, high-level regulation is not really possible.*

Doug Wood, RTT
Seattle Chapter

## And Something To Generate A Little More Controversy...

It should be pointed out that the opinions expressed and procedures

advocated in the following article are those of the individual author. The *Journal* prints such material as food for thought and as suggested procedures for those who wish to try them.

*The use of lacquer to brighten dull hammers has come to be viewed as a questionable practice. Some go so far as to label it "butcher work" or, at best, a last resort. I respectfully disagree with this assessment as I have come to regard the use of proper lacquering techniques as essential in dealing with the hammers of a certain manufacturer of high quality pianos as well as other brands of cold-pressed hammers.*

*The operative word here is proper as it is the improper application of lacquer which is most likely the cause of its bad reputation among technicians. First, let us dispel some of the common misconceptions about lacquer.*

*Myth: A lacquered hammer increases volume at the expense of sustain and tone. Truth: Only if too much or too thick a solution is applied will this be the case.*

*Myth: Once over-lacquered, a hammer is irreparably damaged. Truth: A firm but gentle squeeze on the shoulders with a pair of pliers will soften even the hardest hammer and return it to its pre-lacquered tone.*

*Myth: Lacquer must never be applied directly to the striking point. Truth: Properly thinned lacquer (no less than five parts thinner to one part lacquer) must be applied to the striking point and the shoulders in order to have any appreciable effect.*

*Myth: In the good old days when they knew how to make hammers there was no need for lacquer. Truth: I have seen the telltale signs of hardening solutions on many, fine, vintage pianos of various brands.*

*Myth: Nothing can save an over-needled hammer. Truth: Voicing lacquer can usually return a badly needled hammer to an acceptable tone and volume level.*

*Myth: A lacquered hammer will wear out faster and be harder to file when the time comes. Truth: I have seen no evidence of this. In fact, a set of hammers will last longer because there is no need to file them heavily to bring up the tone initially as is advocated by some. I rarely file new hammers except for a quick shoeshine to remove the cupping at the edges.*

*Myth: New hammers are supposed to be dull but will brighten up with use. Truth: It is the wearing of grooves and subsequent filing that brightens hammers much more than the packing down of the felt. If one were to file even the dullest of hammers to the point of being the same size as the old hammers they would probably then sound about the same. But why should one artificially "wear out" a set of new hammers in order for them to sound right?*

*Procedure: I usually start with a 10:1 ratio of thinner to lacquer. The solution must be thin enough to penetrate the hammer almost to the core all the way around. If it doesn't it means the solution is too thick and should be further thinned. I prefer to use sanding sealer instead of lacquer for two reasons. One, it is somewhat softer when dry than gloss lacquer, and two, it contains stearates, a soap-like substance which makes sanding sealer easier to sand but which also acts as a lubricant for voicing needles, should needling be necessary. Speaking of needling, usually only light surface needling ("sugar coating") will be necessary to even out the tone of the hammers after the lacquer solution has cured. However, if deep needling is indicated it can be done just as with an unlacquered hammer, that is, just on either side of the striking point to reduce volume.*

*The only disadvantages to using voicing lacquer are one, it must harden at least overnight, preferably longer, before the results can be assessed. It is therefore useless as a quick fix before a concert. Two, it may require several trips to the piano before optimum results are attained. And three, lacquer fumes are hazardous to your health and your customers'. Ventilate appropriately.*

Paul Rice, RTT
Maine Chapter

## Flash! Technical Editor Buried In Avalanche!

Of paper, that is. My apologies to those who have submitted material or questions and are patiently wondering if I have dropped off the face of the earth. Well, no, not exactly, but somehow with the holidays, attending the NAMM show, preparing for upcoming teaching in California and New Mexico (not to mention occasionally tuning a piano and running a business) I have been neglecting certain of my editorial duties. Please don't despair, accept my aplogies, and I'll be tackling the correspondence soon (thank goodness for the directory issue next month). ≡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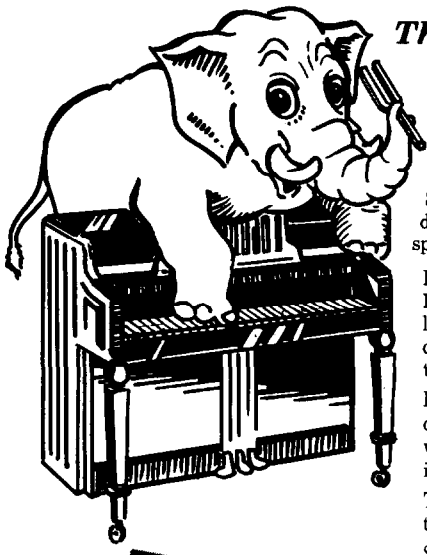

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## TUNING UP

# The Midrange

**Rick Baldassin**
**Tuning Editor**

As I am sure you have noticed, over the past few months Michael Travis has been writing a wonderful series of articles designed to help pass the tuning examination. He mentioned at the onset that he hoped everyone would learn something about tuning in the process.

I have tried to correlate material in this column with his articles, because many new associates reading Michael's articles might not have access to some of the references which Michael lists. This month, we will discuss tuning the midrange.

You may recall from last month, that several temperament systems were listed. If you chose the Sanderson Two-Octave Temperament, you will have tuned all but two notes of the "midrange" set forth in the PTG Exam. If, on the other hand, you chose one of the conventional one-octave temperaments, you will have eleven notes left to tune.

With the traditional one-octave systems, a real switching of gears happens after the temperament is tuned and tested, and this temperament is extended outward, or in other words, the midrange is tuned. This change is because of the way the notes are tuned. In the temperament, the notes are tuned as small intervals (thirds, fourths, fifths, sixths), whereas when extending the temperament into the midrange, these notes are tuned primarily (though not necessarily) as octaves.

When tuning that first octave away from the temperament (F#3 to F#4, for instance) it is crucial that this octave be of the same type or quality as the octave within which the temperament was set. While it is generally true that the octaves become narrower as we go up the keyboard, and wider as we go down, there should be no sudden changes. Therefore, the F3-F4 octave should sound like the F#3-F#4 octave, and the E3-E4 octave, for that matter.

From the above discussion, it is obvious that certain tests are necessary to distinguish between different types of octaves which we tune in the piano. Just a few sentences ago, I said I was printing material in this issue so that some of our new members would not have to refer back to material which was published earlier. Contradicting myself, I am now going to refer you back to number two and number three of the "On Pitch" series of articles which were published in the July and September, 1983 *Journals*. I considered reprinting them here, but looking at all of the graphics gave me a headache. Maybe another day. In the meantime, ask one of your chapter members if you might borrow them for a few days.

These two articles talked about the fact that in octaves and double octaves, there are multiple sets of coincident partials, which all beat at the same time, to one degree or another. Our job as tuner is to eliminate beating in the loudest pairs, while at the same time, minimizing the beats in the other pairs. Sometimes this is no easy task. In the midrange, however, it is usually possible to tune good clean-sounding octaves. They are never "pure," but always have beats present. If the piano was scaled properly and we have done our job correctly, it is possible, however, as Michael Travis puts it, to create the "illusion of purity."

From experience, we have learned that the midrange generally sounds best when we have matched or nearly matched octave partials four and two. Some months ago, I set forth how to determine which type of octave was being tested for by analyzing the ratios of the intervals involved. You may recall from reading the "On Pitch" series, that the two tests listed for the 4:2 octave were the M3-M10 test and the P4-P5 test. Let us examine each to see why these test for the octave at the 4:2 level.

The interval ratio for the Major third is 5:4. The ratio for the Major 10th is 5:2. As we can see, the fives are common to both and cancel out, and the test is for four and two. Simple. Continuing, the ratio for a P4 is 4:3, and the ratio for a P5 is 3:2. In this case, the threes are common and cancel out, and we are again testing for four and two. Again, simple.

I joke about this because I have heard from many how difficult this is to them. Granted, it is more complicated than 2+2=4, but it is just about as basic to piano tuning as simple addition is to mathematics. At one time or another we all had to learn our multiplication tables because our teacher said it would make our lives easier down the road. The same principle holds true here.

Both of the above checks test for the same thing — the 4:2 level of the octave. For this reason, it is only necessary to use one and not both of these tests. Why then are two listed? Just as in temperament setting, some prefer to tune with fourths and fifths because they are slow beating, and others with thirds and sixths because they are fast beating. The P4-P5 test is slow beating, and the M3-M10 test is fast beating. Sometimes you can hear one better than the other. In any case, they will both give you the same result. If the M3=M10, then the P4=P5. Likewise, if the M10 is faster than the M3 by 1/2 BPS, then the P4 will be faster than the P5 by 1/2 BPS.

The past nine paragraphs were meant to tell you that if F3-F4 was tuned such that the M10 was 1/2 BPS faster than the M3, F#3-F#4 should be tuned in the same manner. In tuning the midrange, the 4:2 octave should be wide at the lower end of the range, and become pure by the top end of the range. This means that the M10 will be faster than the M3 for octave C3-C4, and that the amount the 10th is faster will decrease gradually, until by the time you are tuning B3-B4, the M10 should equal

the M3. Eventually, the 10th gets slower than the third, but fortunately, we are not listening for it anymore.

If you are tuning with the Accu-Tuner, setting the SAT one octave above the note being tuned will give you a 4:2 octave, exactly the same as if you tuned it by ear and made the M3=M10. Furthermore, the Stretch Calculator is set up to tune 4:2 octaves that are about 1/2 BPS wide in the lower section, becoming pure by the top of the midrange. (See October 1989 *Journal*, pp. 15-17).

When tuning the midrange by ear, 4:2 octaves are tuned using either the M3-M10 test, or the P4-P5 test. When tuning the midrange with the Accu-Tuner, 4:2 octaves are tuned by virtue of the programming, with the SAT set one octave above the note being tuned. This being the case, it makes absolutely no sense to tune with the Accu-Tuner and then test aurally with the M3-M10 or P4-P5 tests. What checks, then, are appropriate?

The aural checks for electronic tuning are the same as they are for aural tuning — namely, parallel intervals, contiguous intervals, inside third-outside-sixth, and some combination of third-fourth-fifth, fourth-fifth-sixth, or fourth-fifth-10th (which I will describe shortly).

For the slow-beating parallel intervals (fourths and fifths) the object is to play these like intervals chromatically, or sometimes in whole-tone fashion, and see that they all sound about the same. They should speed up a bit as you go up the scale, but this happens so gradually that it is hardly noticeable. If you play the very bottom fifth and the very top fifth, you will hear a difference, but in close proximity, they should sound about the same. The fast-beating parallel intervals (thirds, sixths, 10ths, and 17ths) should form a nice speed progression which increases smoothly as you go up the scale.

Contiguous slow-beating intervals (fourths and fifths) should beat about the same, the top one maybe a little faster than the bottom one. Contiguous fast-beating intervals (M3rds) should beat in the ratio of 4:5. When a note is suspected of being wrong, checking with a contiguous M3rd above and below, contiguous fourth above and below, and contiguous fifth above and below can shed much light on the placement of the note in question. (See September 1987 *Journal*, pp. 27-29, and September 1988 *Journal*, pp. 20-21)

The inside third-outside-sixth test comprises the notes of a dominant seventh chord (F-G-B-D) in third inversion (a fancy way of saying the top note is on the bottom). In theory, the inside third and outside sixth should beat about the same. Inharmonicity in some cases spoils this relationship, but most often, this nearly equal beating relationship will hold true. If both beats are equal in speed, this creates what George Defebaugh calls the piano vibrato. (See September 1987 *Journal*, p. 26, and October 1988 *Journal*, p. 19).

The next series of tests are very helpful in negotiating the break of an instrument, while tuning down from the temperament octave. The test includes two slow-beating intervals (fifth and fourth), plus one fast-beating interval (either M3, M6, or M10), each of which is played up from the note being tuned. If we were tuning note C3, we would first play a fifth C3-G3, followed by a fourth C3-F3. The fifth should not beat faster than the fourth. Since each interval would like the note C3 to move in the opposite direction, a good compromise can usually be achieved. These intervals are followed by playing one of the fast-beating intervals (M3 C3-E3, M6 C3-A3, or M10 C3-E4) and comparing it to the same interval 1/2 step above. If you are able to tune such that the fifth is not faster than the fourth and the fast-beating progression is in line, then you have found the optimum position for that note. It does not really matter which of the fast-beating intervals you use. Because my hand is not big enough to play a M10 with one hand, I generally use the sixth, as it beats a little faster than the third.

Let me emphasize that the same tests which tell the aural tuner that the job has been done properly should be used to tell the tuner using an electronic aid that the job has been done properly.

Even though in some ways we have to switch gears by tuning octaves rather than smaller intervals when we extend the temperament into the midrange, we check our work by using the same tests we used in the temperament, except now there are more notes to test with. With experience, this whole sequence happens very quickly, with an evaluation drawn, and the appropriate changes made. It becomes second nature with practice. Remember, practice makes better.

Some time ago I received a letter and article from Frank McKowen, of Lansing, MI, entitled "This Works for Me." It deals with the subject of temperament and midrange tuning. Please enjoy it, along with "Learning to Pass the PTG Tuning Exam: Part V" by Michael Travis. Until next month, please send your questions and comments to:

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## Practically Speaking

# Upgrading Your Drill Press

Bill Spurlock
Sacramento Valley Chapter

In this article I will present some simple additions and modifications to the basic drill press that can improve its accuracy and usefulness for piano work. As in other articles of this series, I will be describing some basic workshop techniques, such as drilling and threading metal, that can come in handy for many future tool and jig making projects. In this way, I hope to encourage others to expand their abilities and find out just how much they really can do with just a few basic tools.

The drill press can be one of the most useful power tools in the shop. It can drill holes exactly perpendicular to or at a specific angle to the work surface. Clamping a fence to its table allows exact positioning of multiple holes from an edge. Its lever-operated spindle allows enough feed pressure to be applied so a drill will cut instead of just slipping and dulling. The depth stop adjustment allows drilling holes to a predetermined depth. Its chuck will also hold other tools besides drills, such as sanding drums, hole saws, buffing wheels, and rotary planers. Its spindle can even come in handy as an overhead clamp when gluing. Almost all drilling and cutting operations are easier and more accurate when done with a drill press rather than with a hand-held drill motor. As with many tools, a few simple set-up procedures and modifications can make the drill press even more versatile and accurate.

There are a wide variety of drill presses on the market. The most common these days are the Taiwan-manufactured models carried by discount tool suppliers. These can be perfectly adequate tools, especially if carried by well-established tool firms which try to purchase the better grades of imported tools. Drill presses come in a variety of sizes and types; I suggest one with a minimum 1/2" chuck capacity, 1/2 horsepower motor, and 13-inch swing. (The swing is twice the distance from the center of the chuck to the upright column; thus, with a 13-inch swing a drill's center would be 6 1/2" from the column.) Drill presses come in either floor models, which are about five to six feet tall, or bench top models that are around two to three feet tall. The taller the drill press, the thicker the object that will fit between the table and the chuck. Drill presses all have some type of speed changing mechanism, usually stepped pulleys that allow changing the belt position to select spindle speed. Three speeds are usually adequate, but five speeds are better; more are seldom necessary.

I own a five speed "Chicago Power Tools" drill press (apparently there is a Chicago in Tawain also), which I purchased used 12 years ago. Its mechanisms for raising and lowering the table and changing speeds are well-designed and easy to use; it has a good motor and switches and has performed reliably for me. Its only real flaw was an original chuck with excessive run-out (a straight drill held in the chuck would travel in an orbit when turning). While not a problem in many circumstances, excessive run-out can cause inconsistency when doing precision work such as drilling pin blocks. This is a common problem with the imports that can be easily corrected by replacing the chuck with one of higher quality. Lacking a dial indicator, run-out can be checked by mounting a known straight piece of round rod in the drill press chuck and observing any wandering motion of the rod, at a point about four inches below the chuck, compared to a smooth metal block sitting right next to the rod. Rotate the chuck slowly, and with good back lighting watch for any gap that opens and closes between the rod and the block. Ideally you should find less than .001" run-out.

### Replacing The Chuck

Most drill presses have a chuck that is simply pressed onto a tapered spindle. There are a number of different standard tapers used in machine tool spindles; the nameplate of your drill press should identify the taper yours has, such as Morse Taper (MT) number one, Jacobs Taper (JT) number three, etc. Machine tool catalogs list chucks in a variety of sizes and tapers and in a choice of accuracies. One such source is: Enco, 5000 W. Bloomingdale Avenue, Chicago, IL 60639-9981, phone (800) 624-0495. The house brand Enco chuck, at under $30.00, should be perfectly adequate.

The original chuck must be removed either by driving wedges between the top of the chuck and the lower end of the quill, or with a special puller. (The quill is the cylinder holding the spindle, which advances in and out of the top casting when the feed lever is pulled.) If you are not sure how to get the chuck off, remove the quill as described further on, and take it to a machine shop. The new chuck can be installed by opening it completely so its jaws are retracted all the way into the chuck body, and driving it onto the spindle taper with a couple of moderate blows of a mallet.

### Correcting A Wobbly Quill

An additional cause of inaccuracy in your drilling can be a loose fit between the quill and the main casting,

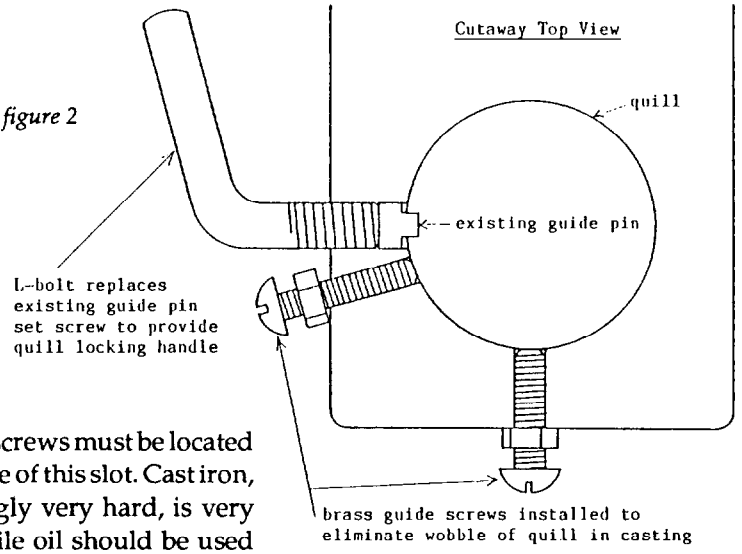
which can allow the entire quill, spindle, and chuck assembly to wobble in the casting. Test for this by lowering the quill a couple of inches, grabbing the chuck, and pulling side to side. High quality tools will sometimes have a means to adjust out any wobble, or will at least have minimal clearance here. Economy grade tools with a wobble problem can be improved by installing brass set screws at four points in the casting to ride against the quill, taking up excess clearance.

To install these screws, first remove the quill. In most cases, this is done as follows: Prop a block of wood between the table top and the chuck so the quill will not fall out unexpectedly. On the left side of the casting there will be a large nut which turns as the feed lever is moved. Remove this nut, which holds the feed spindle and return spring in place. Remove the return spring, counting the number of turns as you unwind it so you can reinstall it the same way. At this point the feed spindle should pull out of the casting from the right side. The quill should now pull out of the bottom of the casting.

Now look up into the hole in the casting and decide where to locate the screws. The hole will probably not be a complete cylindrical opening. Rather, the casting will usually be hollow and have only two round areas that guide the quill. (See Figures 1 and 2) You can install two guide screws in each of these areas as shown. This will require drilling and threading holes in the cast iron; while this operation may sound intimidating if you have never done it, it is actually very simple and is a skill you will find useful in future tool modifications. First, go to the hardware store and purchase four 1/4"-20 (20 threads per inch) brass machine screws and nuts, about 1/2" longer than the thickness of the casting. Then, buy a 1/4"-20 tap and tap handle. There is a specific size hole necessary for each size tap; this will be stated on the tap package, on the lid of a set of taps, and in books of machinists' tables. For a 1/4"-20 tap, you need a number seven drill.

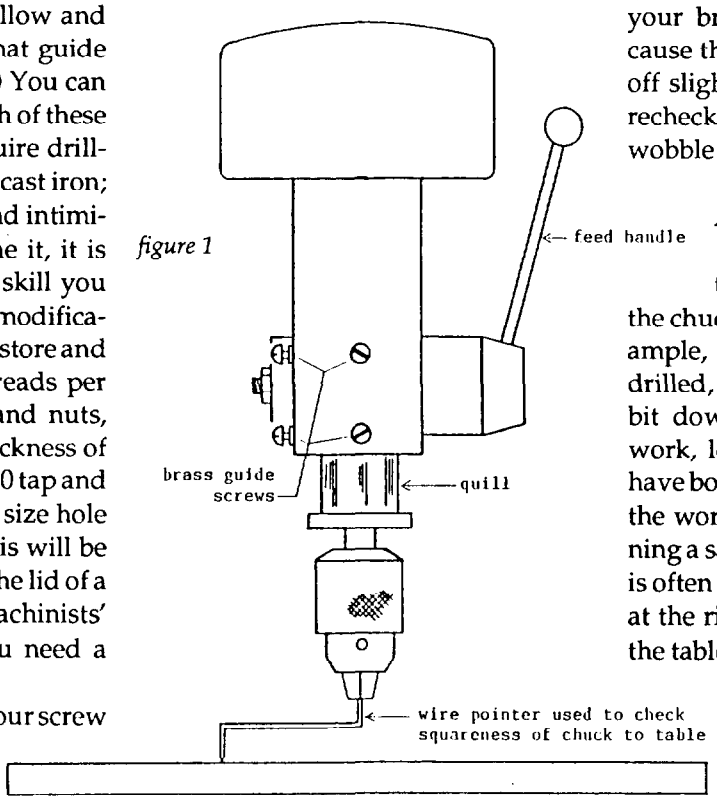
Back in the shop, mark your screw locations with a hammer and centerpunch; this forms a small crater to prevent the drill from wandering as you first start the hole. Some quills have a guide slot along one side, in which a pin or key rides to prevent rotation of the quill in the casting. In this case the side screws must be located slightly to one side of this slot. Cast iron, although seemingly very hard, is very easy to drill. While oil should be used when drilling steel, I normally don't bother with it when drilling cast iron. Just drill your holes, holding the drill as steady as possible while applying enough feed pressure to make the bit cut well. It should take approximately 10 seconds to drill through 1/2" of cast iron. When all four holes are drilled, mount your tap in a tap handle (I prefer the T-handle type) and cut threads in the holes. Here a little oil or thread cutting fluid will help. Keeping the tap in line with the hole, slowly turn it in. After about two to three turns, the tap will tighten up somewhat. If it feels only slightly snug, continue forward until the end of the tap travels about 1/2" out the other side. If the tap gets quite tight, turn it backward 1/4 turn, then forward 1/2 turn, and so on until you are through. Clean any chips from inside the casting and run your brass screws and lock nuts partially into the holes.

*figure 2*




Lubricate all moving parts, and reassemble the quill and feed spindle, making sure the guide slot in the side of the quill aligns with the key or guide pin in the casting. Make sure your return spring has enough tension to lift the quill all the way back up. Now tighten your brass set screws until they just cause the quill to bind, then back them off slightly. Tighten the lock nuts and recheck. You should now feel little or no wobble in your chuck.

*figure 1*




## Adding A Quill Lock

For certain operations it is handy to have a means of easily locking the chuck in a lowered position. For example, when aligning an object to be drilled, it is useful to be able to lower the bit down until it almost touches the work, lock it at that height, and then have both hands free to align and clamp the work to the table. Also, when running a sanding drum or rotary planer, it is often easier to lower and lock the tool at the right height, rather than to raise the table up to meet the tool. Some drill presses have no way of locking the spindle down, while others require turning the depth stop nuts many turns

along a threaded shaft to lock. A simple L-handle locking lever can easily be fitted to just about any drill press by drilling and threading a hole in the casting and installing a 5/16" bolt, bent into an "L" shape, which can then be turned 1/2 turn at any time to bear against the quill and lock the chuck at the desired height. If your drill press has a guide pin riding in a slot in the quill, you can make a lock just by substituting an L-shaped bolt for the existing screw and lock nut that hold the guide pin in place, as shown in Figure 2. The L-bolt then pushes the guide pin into its slot when tightened. Just remove the original screw, take it to a hardware store, and buy something to match (Taiwan units will be metric).

## Adding An Air Nozzle

A great improvement for any drill press is the addition of a compressed air nozzle to cool drill bits and blow sawdust and chips away from the work. Enco (address above) has a nice unit for $6.15 (stock #200-2000). It is a 13-inch long flex hose that stays in any shape you bend it, and comes with a variety of end nozzles. The input end comes with a 1/4" pipe thread fitting which can be screwed into a small brass valve from the hardware store for regulating air flow. The valve can be mounted to the drill press with a bracket, and fitted with a quick-coupler air line fitting, as shown in Figure 3.

## Adding An Auxiliary Table Surface

A drill press can be made more useful for woodworking by adding a larger top to the existing cast iron table. I find formica-topped particle board to be an ideal material here, since it is hard, flat and smooth. Best of all, pieces of this material can be obtained for little or nothing in the form of sink cut-outs. These are the doughnut holes of the counter top industry: pieces of material left after sinks are installed in kitchen counters. Cabinet shops and building supply stores usually sell cut-outs for around $2.00.

You should cut your material to the appropriate size, making sure the sides are square. (Always wear a respirator when sawing particle board.) Position your board on the cast iron drill press table, clamp it in place and drill two holes through the particle board and cast iron with a number seven drill. Then, using your now familiar 1/4" tap, thread the holes in the cast iron. Enlarge the holes in the board to 1/4" and countersink them on the top side so flathead machine screws will seat flush. Now your auxiliary top can go on and off with only two screws, and will always mount in the same position. Finally, drill a hole in the top with a large bit or hole saw, to coincide with the existing hole in the center of the cast iron table. This provides clearance for drill bits as they exit the work. Sealing the bottom and edges with a thin epoxy will help to seal out moisture and prevent warping. You now have a table large enough to support long work pieces, and which can be easily modified or drilled to accept other drop-in fixtures, fences, etc.

## Setting The Table Square With The Chuck

Drill press tables have a tilt adjustment, to allow drilling angled holes. For certain operations, such as use of a rotary planer, it is important that the chuck be exactly perpendicular to the table. Since the indicator on the table tilt adjuster may not be accurate, it is a good idea to check for squareness as follows (see Figure 1): bend a piece of coat hanger into a pointer, put it in the drill chuck, and lock the quill down so the pointer almost touches the table top. Slowly rotate the chuck, watching to see if the pointer stays the same distance from the table surface all the way around. Side to side slant can be corrected by adjusting the table tilt, while fore and aft (in line with the column and chuck) slant must be adjusted by shimming between the two surfaces of the table pivot mechanism. (Brass shim stock is available from auto supply stores and hobby shops.)

## Accessory Tools

Drill bits are obviously the most common accessory used with a drill press. Sets of fractional sizes are available in increments of 1/32" or 1/64". Other drills are available in letter sizes, number sizes, and metrics. Letter drills range from a .234" "A" size to the .413" "Z" drill. Number drills range from the .228" number one, down to the tiny .0135" number 80. A 1/16" to 1/2" set of fractional drills is the best place to start; number or letter drills can be purchased individually for special projects as the need arises. Drills are also available in a variety of different types, such as brad point bits, Forstner-type for drilling flat-bottomed holes, etc. Hole saws are handy for drilling large holes in wood, metal, or plastic, and plug cutters cut wooden plugs for filling screw holes, replacing damaged wood, etc.

A drill press vise is very useful for holding parts (especially small parts) securely while drilling. This is especially important when drilling holes in small pieces of metal, where the bit can catch and spin the piece around, injuring your fingers. Alternatively, small pieces can be held tightly with Vise-Grip pliers. The cross-vise is a particular type of vise with two crank adjustments that move the clamped workpiece fore and aft or side to side, making it an ideal fixture for holding a hammer boring jig. The cranks can be easily adjusted fore and aft to set boring distance, and side to side to keep the bit centered in the molding. The cross-vise needs to be bolted down to a table; rather than bolting it to your formica top each time you need it, it is much easier to have it mounted to its own small plywood square, which then sits on the formica top. A couple of tuning pins or dowels dropped into matching holes in the plywood and the formica table are all that are needed to hold the vise in place.

A rotary planer is a unique and very useful drill press accessory. The best one on the market is the Medallion Planer ($40.00), P & R Tool Co., P.O. Box 606, Sand Springs, OK 74063, (918) 245-

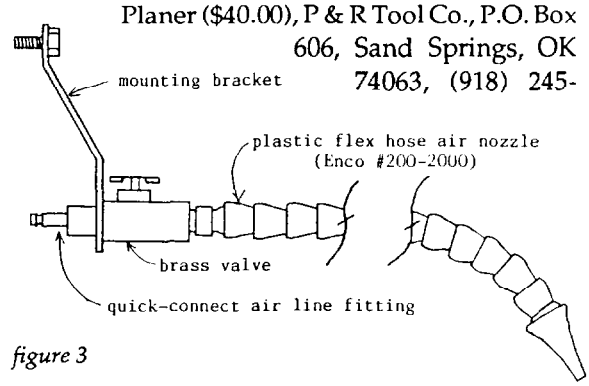


*figure 3*

8720. (It is also available as the Shop-Smith planer from Shop-Smith stores). This tool is a 3 1/2" disc with three cutters. It needs to run at least 3,000 rpm, and since the cutters barely protrude beyond the tool's edge, the cutting action is very smooth and relatively safe. This planer can be used to reduce the thickness of a board, to cut rabbets and tenons, and with the table tilted, to cut bevels and coves. I have used this tool for years to mill down keys when recovering with new plastic keytops, as shown on this issue's cover. For this purpose, I clamp each key in a drill press vise which has been fitted with a special fixture to position each key the same. The added mass of the vise also steadies the key and makes for a very smooth cut.

If by now you have not completely filled your shop with sawdust, try running a drum sander in your drill press! These are available in a whole range of diameters, from 1/2" up to three inches or more, and in various lengths. As described in last month's article, a sanding drum does a wonderful job of sanding bushing cloth and leather to the desired thickness for key rebushing.

Buffing is another operation ideally suited to the drill press because of the variable speeds available. You can either purchase arbors for your buffing wheels or just make them from pieces of 1/2" thread stock, nuts and washers. With the proper compounds and wheels, metal, plastic and ivory can all be polished.

Not to be overlooked are the drill press's uses while unplugged, including clamping glue joints using the quill as a mechanical "go-bar," and installing grand backchecks as described by Susan Graham in the January 1988 *Journal* issue. If that's not enough things to do with your drill press, let me tell you about my new egg-beater attatchment...

Next time I'll describe a system of key balance rail hole repair using a table mounted router, drill press, and a simple marking tool that gives foolproof results.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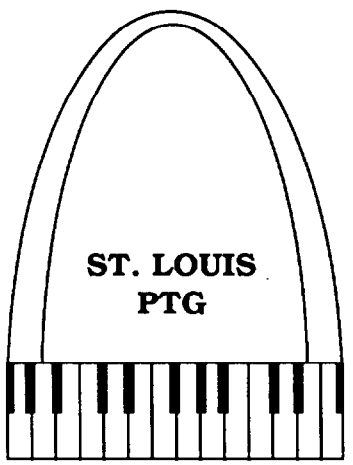


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# Industry News

## Pierce Atlas In Ninth Edition

A ninth edition of the "Pierce Piano Atlas," often referred to as the "Bible of the piano business," has been released by the publisher, Bob Pierce.

The new edition has been expanded to include nearly 12,000 names, providing reference to piano serial numbers, dates of manufacture, factory location and other pertinent information. It includes a "did you know?" section containing historical piano facts and figures — "Elias Schlengel built an oval piano in 1794" — as well as a section containing photographs and highlights of Pierce's 63 years in the music industry. He began his career in the piano and organ business as a $10 a week office boy, and later became the first Hammond Organ salesman.

The ninth edition of the Pierce Piano Atlas is available from Bob Pierce, 1880 Termino Ave., Long Beach, CA 90815, for $17.95, plus $2 postage and handling.


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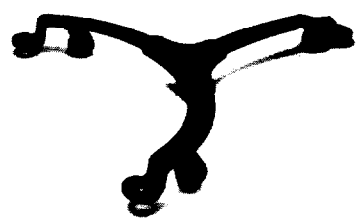

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EXAMINATIONS

# Learning To Pass The PTG Tuning Exam: Part V

**Michael Travis**
**Washington D.C. Chapter**

There are three important assets contributing to high-level piano tuning: time, ability and attitude. Each works together with the other two for the best results. You need to spend an appropriate amount of time at the piano to be sure your tuning attains a high standard, but all the time in the world won't help if you don't have the desire or ability to accomplish a fine tuning. And whereas 45 minutes may be appropriate for a "trash and junket" spinet, it will not likely be enough for best results on a fine grand.

Being able and having time to do well is not enough without the desire; often, this is the missing factor when confronted with one of the legions of hopeless spinets, ne'er-do-well consoles, klunker uprights, not-so grands, or other strung denizens of the neglected and forlorn "C's." Do you really want to work on pianos like that? Though most of us do try to provide the best service possible under the circumstances, often the poor condition or quality of the instrument is so limiting a circumstance that it reduces our desire to provide service.

And if you are able and want to do your absolute best job but don't have all the time necessary, you may have to settle for doing as well as you can in the time available and hope it's good enough. Some of us seem to be stuck in this rut permanently, and may even convince ourselves that this limited-quality job is the absolute best that can be done, and it's a waste of time to try to do better, since customers won't know the difference anyway. Though it's sometimes true that going for the best possible result is a waste of time, it is not always true.

When you take the PTG Tuning Exam, you're tuning for people who will know the difference. The habit of saying to yourself, "Why bother, they won't know the difference?" may come back to haunt you as you find you're out of touch with what fine tuning is. The time squeeze can affect your attitude and your ability. Even though given ample time to do extremely fine tuning during an exam (and many do), it's not as easy as it sounds—especially if you're out of practice! But then, you probably wouldn't want to take a test that everyone can pass.

By the way, speaking of time, how long does it take you to do your best tuning on a nice grand that doesn't need pitch adjustment? Between one and two hours seems to be the typical answer to this question. Now: How long would it take you to tune one string per note, 84 notes (C1-B7) as in the PTG Tuning Exam? Whatever your answer, it seems to me obvious that we have allowed adequate time to do a fine quality job of tuning those 84 strings. Isn't it strange that examinees occasionally run out of time when they have about as long to tune just 84 strings as they would normally take for a complete tuning of between two and three times that number of strings? In fact, this is among the chief causes of failure in the tuning test: taking too much time in the early sections (pitch, temperament and/or midrange) and not having enough time to finish all the remaining sections of the first part of the exam (bass, treble, high treble). I have tried to address this problem in my previous articles, and have stressed before the importance of tuning all the notes at least once. I have also mentioned the desirability of maintaining a professional attitude when taking this test, so that your emotional state does not interfere with your ability to profit from the experience. You should just do your best, first understanding the task at hand, then applying yourself to it in as relaxed and efficient a manner as you're capable of. You needn't raise the emotional stakes so high for yourself that you risk falling from that height if you don't do as well as you'd hoped in all sections of the test. Look at it this way: your scoresheet could be your prescription for success in a subsequent attempt if you read it right.

Considering a somewhat larger context, those who do well on the RTT exams are usually those who have taken the time to learn and practice their skills, and have sought the criticism of others to gauge their progress. PTG offers many opportunities for improving your skills in classes and tutoring sessions at conventions and seminars, such as the one in Dallas this July. For those with a desire to learn who invest the time and money for the opportunities PTG provides, your abilities can only expand.

But you already knew that, didn't you? To continue now with our regularly-scheduled program, having ended the last article after setting pitch and tuning a temperament, we arrive now at this very paragraph to ask, how do you aurally tune the midrange, and how do you "edit" (check and correct) your tuning? What are some good aural tuning checks to use in the midrange?

In the PTG Tuning Exam, the midrange consists of the 24 notes from C3 through B4, which make up octaves three and four. It is the third scored area of the exam, and follows pitch and temperament. It is followed by the areas of bass (octaves one through two), treble (octaves five through six), high treble (octave seven), stability and unisons (both only in octaves three through four). To pass the exam, everyone has to pass the pitch, temperament and midrange sections tuning aurally only, by scoring at least 80 percent in each of these categories.

Once you have set a good "equal temperament" on a well-scaled piano (the kind we use for tuning exams), you will find that the remaining notes of the midrange will fit into place like the pieces of a jigsaw puzzle, accumulating more interval checks as the tuning grows. There is a kind of inevitability to the process, once you have a good start. Since there are so many possible temperament sequences you could have used (see references at the end of the previous article in this series), I will only assume here that you have achieved a result which more or less satisfies the following criteria:

1. A4 is at A440; 2. The octave notes of the temperament sound clean and pure together; 3. Parallel P5s all sound consonant, about the same, and are all slightly contracted; 4. Parallel P4s all sound consonant, about the same, and are all slightly expanded; 5. P5s are slower-beating than P4s with either a common top or bottom note; 6. Pairs of contiguous M3s beat in an ascending 4:5 bps ratio. 7. Parallel chromatic M6s and M3s show smoothly changing beat rates. 8. All notes are stabilized so they won't require retuning later.

If the above criteria are met, tune the rest of the midrange, expanding your temperament, checking and stabilizing as you go. You may wish to do the first pass through the temperament and midrange fairly quickly, since you will be dealing with an artificially de-tuned piano (see part two of this series). Do whatever works best for you. Budget your time: octaves three and four may take up to half of your total time limit allowed, or 45 minutes out of a 1-1/2 hour aural exam. That might break down as follows:

1. 2.5 minutes — set and stabilize A4 at A440 2. five minutes — quick-set temperament — first pass 3. five minutes — quick-tune midrange — first pass 4. 2.5 minutes — recheck/correct A4 at A440 5. 10 minutes — set and stabilize temperament 6. 10 minutes — fine tune remainder of midrange 7. 10 minutes — recheck/correct all midrange notes

**Hint #16:** Practice as much as necessary aurally tuning at least the midrange of a well-scaled grand in advance of the exam, strip-muting and nudging midrange notes alternately sharp and flat to simulate the exam's detuning. Make sure you can do your absolute best work from C3 to B4 in no more than 45 minutes. Be strict with the time, so you will be able to do a good job in the midrange on exam day and still have ample time to finish the rest of the piano.

Now that we've established goals for temperament tuning and budgeted the time to set pitch and tune the temperament and midrange, let's have a look at some particularly useful midrange tuning checks.

## Basic Midrange Tuning Checks

I would suggest you sit at a piano keyboard while reading what follows so it will be more meaningful to you. Here are some basic aural checks useful for midrange tuning.

### Octaves

Single octaves (C3-C4, C#3-C#4, etc., through B3-B4) should all sound pure, with a slight roll in the 2:1 coincident partials being allowed as long as the overall illusion of purity and clarity is there. A good midrange octave beat rate check is the M3-M10 (third-10th) test. Example: check the F#3-F#4 octave by playing D3-F#3 (M3) versus D3-F#4 (M10). Identical beat rate indicates matched 4:2 pair of coincident partials. Slight further expansion is okay, (M3 beats slightly slower than M10) so long as clarity of the octave is maintained.

### Fifths

P5s (C3-G3, C#3-G#3, etc., through E4-B4) should all sound similar and clean, but not necessarily as pure as the single octaves. Midrange P5s are contracted intervals, and proper tempering of a P5 is indicated best by the M6-M10 (sixth-10th) test. Example: with the M10 F3-A4 beating on the wide side of pure, check D4-A4 P5 by playing F3-D4 (M6) versus F3-A4 (M10). The M6 should beat slightly faster than the M10, indicating that the P5 is contracted at the 3:2 partial level, but not so much faster that the P5 has an offensive beat rate. Note: in the low midrange of some higher-tension scales, properly tempered P5s may seem to "whine" excessively due to a relatively loud pair of 6:4 coincident partials an octave above the 3:2 pair. It may be possible to make the P5 purer at the 3:2 level to help clean up this interference, but you may have to delay making this judgment until you've tuned more notes below the midrange.

### Fourths

P4s (C3-F3, C#3-F#3, etc., through F#4-B4) should all sound similar, fairly clean and nearly as pure as the P5s. Midrange P4s are expanded intervals, and proper tempering of a midrange P4 is indicated best by the M3-M6 (third-sixth) test. Example: with the M3 E3-G#3 beating on the wide side of pure, check G#3-C#4 P4 by playing E3-G#3 (M3) versus E3-C#4 (M6). The M3 down from the bottom note of the P4 should beat slightly slower than the M6 down from the upper note, indicating that the P4 is expanded at the 4:3 pair of coincident partials, but not so much slower that you have an offensive P4 beat rate.

### Thirds

M3s (C3-E3, C#3-F3, etc., through G4-B4) should rise smoothly in beat rate playing a parallel series up the scale, either chromatically or by whole-tones. Of particular interest here is the relationship between contiguous pairs of M3s, (example: C3-E3 and E3-G#3; note E3 is common to the pair) of which the beat rates of the lower member and upper member are in the ratio of 4:5. Learn this ratio so you can recognize a deviation from it.

**Hint #17:** Practice hearing the 4:5 ratio of ascending contiguous M3s by listening first to the lower M3 counting beats 1-2-3-4-1-2-3-4-1-2-3-4, accenting the one each time. Then, using the same length of time between ones, see if the upper M3 beat rate can be counted 1-2-3-4-5-1-2-3-4-5-1-2-3-4-5. If not, adjust the "bridge" note until you can count 1-2-3-4 in the lower M3 and 1-2-3-4-5 in the upper M3 in the same amount of time. Soon you will be able to just play pairs of contiguous M3s and immediately know whether the proper 4:5 ratio exists, and what you might want to do if it doesn't.

## Contiguous Interval Tests

The contiguous M3 test is particularly useful from about F4 down as low as you can hear beats clearly, and is effectively applied in conjunction with the contiguous P4 test and contiguous P5 test (described later) to make a judgment on how to correct the tuning of an

individual note. Examiners often use these tests to aurally verify the direction of an alleged error, so you should at least understand how to use them as well.

## Tenths

M10s (C3-E4, C#3-F4, etc., through G3-B4) should rise smoothly in beat rate playing a parallel series up the scale, either chromatically or by whole-tones. The ascending 4:5 beat rate ratio described above for contiguous M3 pairs also applies to M10s pairs where the lower members of the two are related as M3s. Example: observe 4:5 ratio as you play the M10s C3-E4 versus E3-G#4.

## Sixths

M6s (C3-A3, C#3-A#3, etc.) are mainly useful in the same range as the M3s, played parallel ascending either chromatically or by whole tones. There is a very useful relationship between M6s and M3s we can use analytically as the "outside sixth-inside third" test, and is great for going down from the temperament area and getting across that sometimes treacherous bass break. The idea is that to judge a note being tuned, play the M6 up versus the M3 which is "inside" the M6, with it's lower note a whole tone up from the lower note of the M6. The beat rates should closely match. If they don't, and you're reasonably sure every note other than the one you're tuning is okay, then it becomes obvious which way you have to go to make the M6 which you are tuning beat the same as the "inside M3" you have already tuned. Example: tuning C3, play C3-A3 versus D3-F#3. Tune C3 to adjust the M6 beat rate to match that of the M3.

Obviously, given the time limitations of the exam, you may not be able to use all the aural checks given above. Think of them this way: they are like a set of tools which you apply in conjunction with your tuning hammer to produce as good an imitation of equal temperament as the piano will allow. For more efficient work, you will over time decide you like to use some intervals more than others.

For example, moving down from the temperament, you could play a number of intervals up from the note being tuned and quickly decide which way to move it: octave, P5, P4, M6, and M3, followed by a few parallel M3s leading down to the note being tuned, and maybe the outside sixth-inside third test. At some point in all this you should give the key a good *Whack*! or two, noting before and after beat rate speeds to judge stability. After tuning four to five notes, you can check parallel M6s and M10s and see if there are any too fast or too slow.

An even simpler pattern for fast tuning would be octave, P5, P4, M6, *Whack*!, M6. When your tuning hammer technique is good, the test blow won't produce any change in the M6 beat rate before and after.

Moving up from the temperament you will likewise find some checks more useful than others, and will for the sake of efficiency lean on just a few checks to get through most of the upper midrange, going back to recheck things by running your parallel M10s. The pattern of checks most often used going up is (with the note being tuned as the top note of the interval this time) octave, P5, P4. Tune a few, check the 10ths.

Among your final series of midrange checks, run long strings of parallel 10ths, then octaves, listening closely for irregularities, correcting where possible. Then, for each individual note in the midrange where it's possible to do so, check contiguous P4s and P5s. Example: check C4 by playing the P4s G3-C4 versus C4-F4, and the P5s F3-C4 versus C4-G4. Contiguous P4s and P5s should sound about the same on both sides of the note you're looking at. You may also use contiguous M3s mainly in the lower midrange where the beat rates are slow enough to count. This final checking is like traveling hammers, folks, you do it fast and get an immediate impression, and if something sticks out, you decide quickly what to do about it; whether, in the constellation of intervals of which that note is the central member, more intervals will be helped or hurt by moving the note one way or the other.

Bear in mind that some pianos just won't let you have your cake and eat it too, and you have to tolerate something less than perfection and just keep on moving on. I feel that where such choices are required, it's best to favor the octaves, fourths and fifths — the consonant intervals, doing the best you can to preserve orderly transitions in the thirds, sixths and tenths.

Before drawing this article to a close, I'd like to mention a special test which some people may find useful. But first I should mention that there are many tools in my tool kit which bear the names of the technicians I learned about them from. For instance, there's the 10" x 3/16" shank-slot screwdriver, which I use, among other things, for getting between hammershanks on verticals and bumping strings down to the upper treble bridge when I just don't have time to pull the action and seat all the strings with the brass drift punch. That's my "Dodson" screwdriver (after the late Ned Dodson, Washington, D.C. Chapter member). Then there's the more recent replacement for the film can of VJ lube, a flattish plastic number with a lid that is attached to the base (a no-lose proposition), takes up less space in the tool kit and still holds an ample supply of VJ goop and cost me a whopping 20 cents from the local camping supply store — that's my "Graham greasebucket." Thank you Susan. *(The VJ lube to which Michael refers was named for the late Vic Jackson, another great PTG member. Editor)*

Well, here's another tool you might find interesting, the "Harvey Chord," promoted by Jim Harvey, frequent seminar and national institute instructor. It works! Well, pretty good, anyway. Mainly, it's fast — suitable for the first pass from the midrange up through octave five (after which you'd probably want to switch to single octaves only on the first pass). With one hand on the tuning hammer which is on the appropriate pin, play the "Harvey Chord" with the other hand, and adjust the pin to minimize the beats. The "Harvey Chord" is as follows: octave, fifth, fourth, and note being tuned. No, you don't play the octave, then the fifth and then the fourth. That's not the idea. You play all these notes together and tune to minimize the beats. Very efficient! One example: tuning C5, play simultaneously, C4, F4, G4, C5 and adjust C5 for the cleanest (least-dirty) sound. Next note!

Well, I don't know if you've found your lost chord or not in all this, but I do hope you have some additional ideas on midrange tuning. To summarize, in taking the tuning exam, plan on spending no more than 45 minutes to set pitch and temperament and fine tune the midrange octaves, three and four. Con-

centrate on making the consonant intervals consonant (octaves, P5s, P4s) and faster-beating intervals smoothly progressing in beat rate. Learn the beat rate checks for P4s and P5s, and how to use contiguous intervals to your advantage. Be aware also that this is the area where we subsequently test stability, and that your strings will have to survive three medium-hard test blows without changing very much at all (for that part of your score). Prepare for tuning the midrange on the exam by practicing on a good quality grand piano, and using all the tests mentioned in this article. If you are unsure how some tests should be applied, consult with a friendly RTT in your area, or feel free to write or call me. I'm in the PTG directory.

Though I hope reading this and other articles has helped you as you prepare for the exam, you should also be gaining experience in fine tuning by taking the time every day to slow down and listen, patiently applying your new knowledge of aural checks as you find out what works best for you. If possible, get some guidance from the best tuning tutor you can find. Attend tuning classes at seminars and conventions, sign up for tutoring when it is offered. Someday maybe you will also carry your friends, colleagues and instructors with you on every job, and realize that wherever you go, help is close at hand. (Somebody find me a C-clamp so I can get that kit closed!)

Next month: Bass


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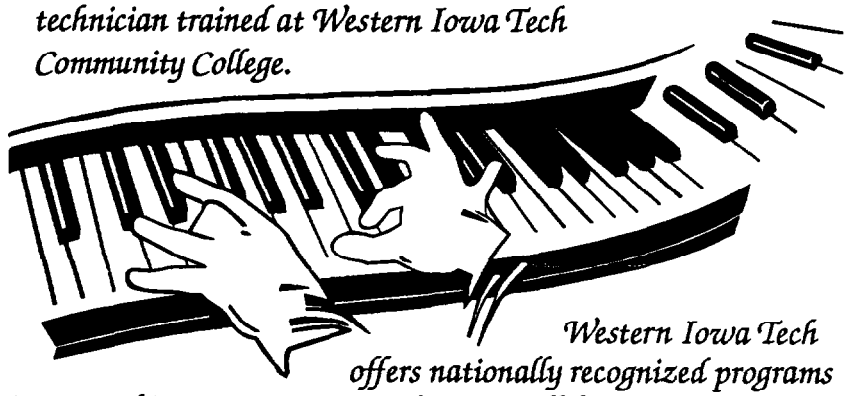

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## At Large

# This Works For Me

**Frank McKowen**
**Lansing Chapter**

This article is designed as a guide to help beginning tuners. Experienced tuners may find in these procedures an idea or two worth trying, and they are welcome to "help themselves." Many fine tuners have shared their expertise and ideas with me over the years, including local colleagues as well as PTG workshop and seminar experts too numerous to acknowledge individually.

The logical sequence for complete piano care is to: 1. Clean, 2. Repair, 3. Regulate, 4. Tune, and 5. Voice. This article, however, will deal primarily with tuning.

Assuming a solid background in the necessary music theory, probably the most difficult hurdle for the novice tuner is to develop the ability to hear the beating of the coincident partials of the intervals used in tuning, and to quickly discern the rate of speed of these beats in terms of number of beats per second. Apprenticing with an experienced tuner can be a great help.

There are many systems or patterns for setting the temperament. Some of these patterns tune with thirds and sixths, and test with fourths and fifths, while other patterns call for tuning with fourths and fifths, and testing with thirds and sixths. Either system has merit, and the choice is up to the tuner.

The White System, from "Piano Tuning and the Allied Arts," by Dr. William Braid White, uses fourths and fifths, tuning ascending fifths and descending fourths. This system, however, requires the tuner to achieve his tempered fourths and fifths on the "flat side" of pure. (Keep in mind that all tempered fourths must be tuned slightly wide, and all tempered fifths must be tuned slightly narrow, regardless of which system is used). The system which I like and have used for many years uses fourths and fifths also, but in reverse order, i.e. fourths ascending and fifths descending. The fourth is tuned by gradually slowing the beat rate of the upper note, and the fifth by gradually slowing the beat rate of the lower note. Each tempered interval is thereby tuned on the "sharp side" of pure. The theory behind this is: That it's easier to hear something than nothing. You simply slow the beat rate down until the correct rate is heard, then stop. Not only are these beat rates easier for me to hear and control, but by tuning each interval from the "sharp side" in this manner, I find that the pin torque is more readily stabilized. So mute the piano, and give this system a try.

*(Editor's Note: This system was written originally with flats and sharps, used interchangeably to make the interval spellings work out correctly. In addition, the original octave numberings changed between G# and A. In order to make this conform with the other temperament systems presented, this system has been edited to include only sharps, and to have the octave numberings change between notes B and C, A4=440. Interval tests listed in brackets [...TEST] refer to the Summary of Tests listed after the temperament procedure. RB)*

Tune C5 from fork. (I use a C fork because the note C lies a fourth above F3 and a fifth below F4, the generally accepted temperament section on the piano. Since I tune with fourths and fifths, this makes the C fork my most logical choice). [FORK TEST]: Check that G#2/C5 beats the same as G#2/fork. The G#2 is below the temperament section, but is usable as a reference note in testing. If the piano is considerably flat, G#2/C fork will beat much too fast to be very useful. This is why I find it helpful to raise the piano's overall pitch to A440 with an electronic aid before attempting to fine-tune aurally. Tune C4 and C3 from C5. [OCTAVE TESTS]. Also check the third, 10th, and 17th from G#2. Tune F3 from C3. [FOURTH TEST]. Also [FIFTH TEST]: down from C4. Remember that the sixth will beat one BPS faster than either the third (in the FOURTH TEST) or the 10th (in the FIFTH TEST). Tune F4 from F3. [OCTAVE TESTS]. Tune A#3 from F3. [FOURTH TEST]. Also [FIFTH TEST]: down from F4. Tune D#4 from A#3. [FOURTH TEST]. Tune D#3 from D#4. [OCTAVE TESTS]. Check M6th D#3-C4 at seven BPS. Tune G#3 from D#3. [FOURTH TEST]. Check M3rd G#3-C4 at 8-1/2 BPS. Tune C#4 from G#3. [FOURTH TEST]. Check M3rd C#4-F4 at 11 BPS. Tune C#3 from C#4. [OCTAVE TESTS]. Check M3rd C#3-F3 at 5-1/2 BPS. Tune F#3 from C#3. [FOURTH TEST]. Also [FIFTH TEST]: down from C#4. Check M3rd F#3-A#3 at 7-1/2 BPS. Tune F#4 from F#3. [OCTAVE TESTS]. Tune B3 from F#3. [FOURTH TEST]. Also [FIFTH TEST]: down from F#4. Check M3rd B3-D#4 at 10 BPS. Tune E4 from B3. [FOURTH TEST]. Check M3rd C4-E4 at 10-1/2 BPS. Tune E3 from E4. [OCTAVE TESTS]. [INSIDE THIRD/OUTSIDE SIXTH TEST]: M6th E3-C#4 and M3rd F#3-A#3, both at 7-1/2 BPS. [CONTIGUOUS THIRDS TEST]: C3-E3, E3-G#3, G#3-C4, C4-E4 (each 1-1/2 beats faster than the preceding). Tune A3 from E3. [FOURTH TEST]. Check M3rd A3-C#4 at nine BPS. [INSIDE THIRD/OUTSIDE SIXTH TEST]: M6th D#3-C4 and M3rd F3-A3, both at seven BPS. [CONTIGUOUS THIRDS TEST]: C#3-F3, F3-A3, A3-C#4, C#4-F4. Tune D4 from A3. [FOURTH TEST]. Check M6th F3-D4 at eight BPS. Tune D3 from D4. [OCTAVE

TESTS]. [INSIDE THIRD/OUTSIDE SIXTH TEST]: M6th D3-B3 and M3rd E3-G#3, both at 6-1/2 BPS. [CONTIGUOUS THIRDS TEST]: D3-F#3, F#3-A#3, A#3-D4. Tune G3 from D3. [FOURTH TEST]. Also [FOURTH TEST]: from C4. [INSIDE THIRD/OUTSIDE SIXTH TEST]: M6th F3-D4 and M3rd G3-B3, both at eight BPS. Also M6th C#3-A#3 and M3rd D#3-G3, both at six BPS. [CONTIGUOUS THIRDS TEST]: D#3-G3, G3-B3, B3-D#4. Tune G4 from G3. [OCTAVE TESTS]. [CONTIGUOUS THIRDS TEST]: D#3-G3, G3-B3 B3-D#4, D#4-G4.

• This completes a temperament of an octave and a half. At this point, extend the temperament (by octaves) up to and including C5, so that there are two full octaves. This is a good time to make a final check of all chromatic thirds, sixths, and 10ths, for smooth acceleration. Also, check for quiet contiguous fourths.

With the temperament now firmly set, continue by tuning all the Fs above the temperament, listening to the third-10th-17th from C#3 and C#4. Each interval must get gradually faster. From F5 and up, listen for pure fifths-12ths-19ths against A#5. When all the Fs have been tuned, tune all the Cs, listening to the third-10th-17th from G#3, and pure fifths-12ths-19ths against any and all of the Fs that were just tuned. After the Cs are all tuned, the Gs are tuned in like manner, checking with the Cs just tuned. Proceed around the circle of fifths, listening for smoothly faster 10ths and 17ths, and pure 12ths and 19ths from the notes just tuned. By tuning the circle of fifths, there is always a fifth tuned to check against each new series. Spreading the tuning out in this manner (as opposed to tuning chromatically all the way up), seems to help spread the added tension more evenly throughout.

In tuning the bass, I tune down chromatically. The easiest checks are probably descending thirds, 10ths, and 17ths. They must gradually slow down as you descend. In the upper bass, down to about F2, the m3-M6 octave test is also useful. From C2 to the bottom, I like to use the octave-minor seventh (C2-A#3) described in the footnote on p. 107 of "Tuning and the Allied Arts" by William Braid White. This interval beats at eight BPS, and slows down as you descend to the bottom of the keyboard.

## Summary Of Tests

[FORK TEST] Setting C5 to the C fork (523.3 BPS), test the beating of G#2-C5 (a M17th) with the beating of G#2 and the C fork. The beat rates should be identical. G#2 has not yet been tuned, but is a reference note. G#2 may need to be adjusted to obtain a usable beat rate.

[OCTAVE TESTS] M3-M10 Test: If testing the C3-C4 octave, compare the beating of G#2-C3 (M3) and G#2-C4 (M10). If these intervals beat the same, (the 10th may be slightly faster than the third), the octave is in tune. m3-M6 Test: If testing the C3-C4 octave, compare the beating of C3-D#3 (m3) and D#3-C4 (M6). If these intervals beat the same, (the M6th may be slightly faster than the m3rd), the octave is in tune. Due to the speed of these beat rates, this test is most useful from F3 down to about C2. P4-P5 Test: If testing the C3-C4 octave, compare the beating of C3-F3 (P4) and F3-C4 (P5). If these intervals beat the same, (the fourth may beat slightly faster than the fifth), then the octave is in tune.

[FOURTH TEST] M3-M6 Test: If testing the F3-A#3 fourth, compare the beating of C#3-F3 (M3) and C#3-A#3 (M6). If the fourth is expanded, the sixth will beat faster than the third (about one BPS difference). The note C#3 is a reference note, and is valid even though it may not be tuned yet. C#3 may need to be adjusted to obtain a usable beat rate.

[FIFTH TEST] M6-M10 Test: If testing the A3-E4 fifth, compare the beating of C3- A3 (M6) and C3-E3 (M10). If the fifth is contracted, the sixth will beat faster than the 10th. The note C3 is a reference note, and is valid even though it may not be tuned yet. C3 may need to be adjusted to obtain a usable beat rate.

[INSIDE THIRD/OUTSIDE SIXTH TEST] The inside third (C3-A3) should beat at the same rate as the outside sixth D3-F#3). Played together, these notes (C3-D3-F#3-A3) spell a D7 chord in third inversion, and there should be one predominate beat heard. Use this pattern throughout the temperament.

[CONTIGUOUS THIRD TEST] Each successive M3 will be faster than the the previous third by about 1-1/2 BPS. Another way to look at it is that the upper third will be faster than the lower third by the ratio of 5:4. Other useful tests m3-M3 Test: The minor third (C3-D#3) will beat at the same speed as the major third (F3-A3). Played together, these notes (C3-D#3-F3- A3) spell an F7 chord in second inversion, and there should be one predominate beat heard. Use this pattern throughout the temperament. Contiguous fourths: (G3-C4-F4) Listen for smooth, quiet intervals. Contiguous fifths: (F3-C4-G4) Listen for smooth, quiet intervals. ≡


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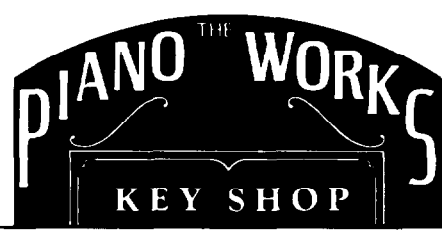


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## GOOD VIBRATIONS

# Bridge Renotching

Nick Gravagne
New Mexico Chapter

In its final stages of decrepitude an old piano bridge looks hopelessly lost even to the customer. Gaping cracks, long splits, ugly pins which have arrogantly wandered into those splits, and a general appearance of ill-being are signs aplenty (even to the untrained eye) that the bridge is in trouble. When such is the case, a new cap or a new bridge should be installed. This is a big job and requires much of the rebuilder in terms of know-how, tools and time. Happily, though, some seemingly dead bridges are prime candidates for reconditioning, and many which may appear to be only shadows of their former selves can not only be resurrected to new life but actually made to look, if not exactly like new-born babes, at least like well-heeled senior citizens. Moreover, the vulgar tonal language spewing from the unregenerate bridge, which sounds, according to one of my Thespian customers, like Liza Doolittle in her artless days, can be cleared up into something resembling a piano's version of the King's English. And this brings us to the second article in this series on bridge work: bridge renotching.

In a properly functioning bridge the speaking length of the string should be sharply terminated simultaneously at the cut notch *and* the "side" of the bridge pin as illustrated in Figure 1. Such an arrangement assures that the vibrating string will not be confused; that is, it has one — and only one — speaking length, and therefore one vibrational mode which is, for all practical purposes, unchanging in both its fundamental and segmental behavior. But Figure 2 shows what can happen, and usually does, to this termination point, especially in the higher third of the scale where the notches are sometimes simply beveled rather than sculpted. Notice that the string is confused due to the wooden termination point of the bridge having "crept" forward under the pressure of downbearing. That is, the string cuts in the hardwood have effectively lengthened the bridge top causing the front termination to be forward of the pins. Since the string now has two primary termination points and lengths, and an infinite number of secondary points and lengths (between A and B), it doesn't know exactly what note to sing when called upon to do so. "Do you want 440 or 441, maestro?" This is bad enough for the fundamental, but its segmenting choirmates are in an even worse quandry. Ranking in order to loose bridge pins and inadequate downbearing, false beats belch out of a piano due to poor string terminations found at the wooden bridge or at the capo bar, agraffe, V-bar *et al.* Bridge renotching, then, re-establishes the coincidental termination of notch and pin; and our frustrated string along with its sister partials are once again free to sing many clear hosannas.

*figure 1*

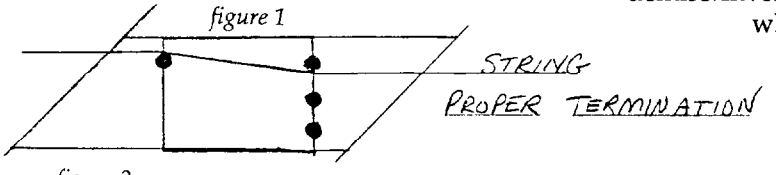
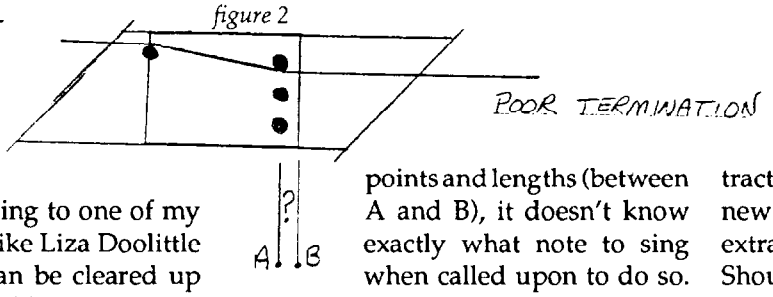



*figure 2*




The renotching process itself begins as trial and error. Sample notches must be worked over to ascertain the probable effectiveness and workability as a wholesale approach. First sweep away the generations of accumulated crud (an old toothbrush is handy), and have a look-see. Wishful thinking will translate and downgrade a repugnant crack to a "hairline" or "cosmetic crack only." Be ruthless. Be objective. There can be no rules here but a few guidelines are in order. A hairline crack should actually *look* like a thin strand of hair lying at the base of the pin. An open or gaping crack, one you can actually stick something like a needle into, may be so deep as to indicate serious structural demise. Investigate the upper scale where the pins tend to be crowded: Are rows of pins joined by a continuous crack? Remember that a small crack at a tenor pin may be too large at a treble pin. Consider the tightness of the pins; are they too easily extracted with small pliers? (New pins in a new bridge cap are almost impossible to extract without vise-grips locked on). Should the pins be uncommonly tight it is perhaps better to leave well enough alone and clean up the bridge in your usual way. In such a case it is possible, if not a bit difficult, to "renotch" with the pins in place by using the point of a scraper, or a razor blade, or some other tiny cutting tool. The idea is to remove the little string cut that has advanced forward of the pins. But if the pins can be pulled without damaging the bridge, and the general condition of the bridge seems to warrant renotching rather than recapping, several pins need to be pulled out and some trial cuts made at the notch with a sharp chisel (explained later) in order to determine the likelihood of success both as to mechanics and cosmetics.

But function and looks aren't the only considerations. There is the business end of things too — contractural arrangements, costs, value of the finished piano, customer expectations — which includes building and maintaining an unsullied reputation as a rebuilder with customers and other technicians alike. Some technicians believe that in a serious rebuild, especially one involving a new soundboard, any presence of cracks in the finished product, even of the sort that are non-threatening, is akin to donning a tuxedo with high-top shoes: everything is functional, but don't look too closely. Still, sometimes these cracks can be cut out completely or minimized considerably, and I have done so with bridges that have been subsequently installed on new soundboards.

## The Renotching Technique

Once the pins are out of the way the general idea is to cut down through the diameters of the unison holes (i.e., cut the holes in half) with a sharp chisel so as to "take off the curl" along the length of the original notch. Before this can be done a vertical cut must be made at the juncture where one notch-unison meets another in order to sever and free the wood fibers (photo 1). Failure to do this may result in unwanted removal of wood from an adjacent unison top (or landing) when a curl is being lifted from a notch. This vertical cut is easily made by standing the sharp blade of a chisel into the juncture and tapping lightly with a hammer. Don't worry if the chisel sinks down farther than it needs to, no harm will be done; it is dangerous not to go far enough, though. You will quickly sense the proper feel for how hard to tap the chisel. My vertical-tapping chisel (the cheapest thing I could find) has ground into it a honed curve which more or less copies the carved slope found in many quality bridge notches. But an ordinary bench chisel with 90° corners will work.

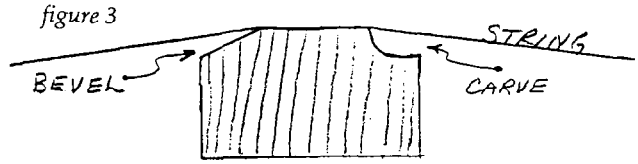
When the vertical cut has been made the notch can be re-cut. My favorite tool for this (as well as for notching new bridges) is a "straight chisel" which has a 16mm wide blade. This is not an ordinary chisel; it is a carving tool which has two beveled sides and rounded heels, a feature which allows for the rocking and scooping motion necessary for making a round cut. Ordinary bench

*photo 1*

chisels are only partially effective in this manner, and depending on the conditions of the notch, completely ineffective at times. (Carving tools are usually only available from specialty woodworking supply outlets and mail-order). It should be pointed out here the difference between a simple beveled notch and a carved, or sculpted notch. See Figure 3. It should be obvious that a carved notch is superior in every way; this will come up again in articles on bridge capping. Photo 2 shows a curl being lifted out of an old notch. In order to cut this curl the edge of the blade must first be placed in an almost vertical position and oriented so as to cut one-half of the holes away. Be careful. This is a critical cut, but nothing like cutting diamonds so save your sweat.

Also, remember not to get too greedy; that is, it isn't necessary to cut through the holes and lift the curl all in one glorious flash. That will come with time, but for now do the renotching in stages. First, simply cut a small amount of material away at one-half the holes by pushing down on the chisel while using a slight scooping motion. Someone described this motion as the same used to open a paint can with a screwdriver. Once this little cut has been made the

*figure 3*



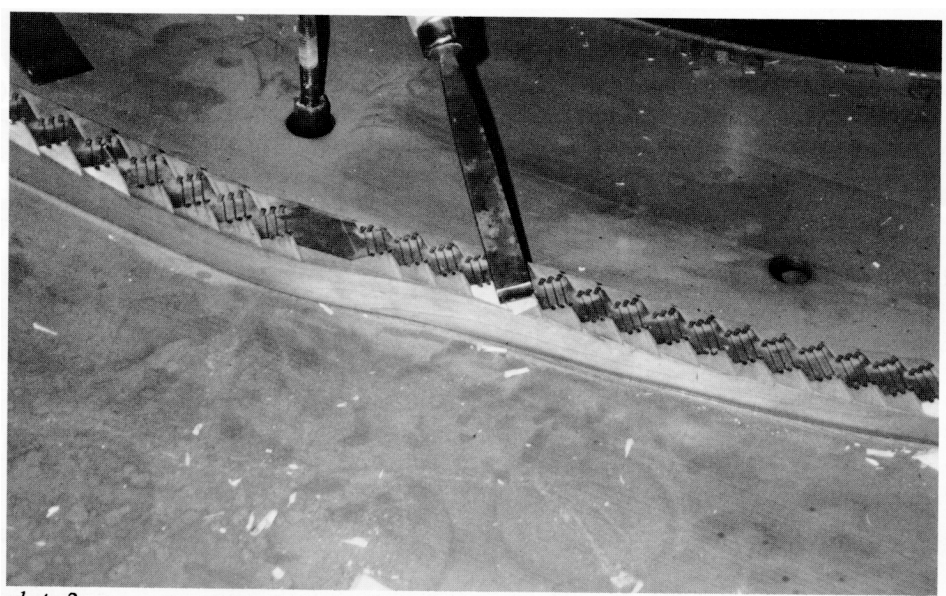



*photo 2*

*photo 3*

mechanics of the termination point will have been served. A subsequent cut (or cuts) is now made in order to make for a neat job and to remove most (or all) of any cracks which may be present. The motion is the same: place the cutting edge of the chisel just ahead of the little cut previously made and push the chisel handle forward and down in order to lift the curl. Watch to see if the first vertical cut, the one made with the small hammer at the adjacent unison juncture, hasn't been "used up." Remake it if the curl is not only curling forward and away from you but is lifting fibers which should have been severed at the side. It is okay to let the flat shank of the blade ride on the point of the notch (figure 4), but over done with big, heavy ordinary bench chisels, this technique will round off that point. If you have never done this work consider starting on the back side of the bridge and cut your notches — and your teeth — there. It is a good place to practice.

*figure 4*

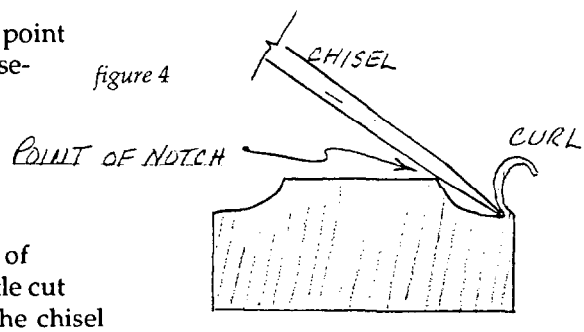



Photo 3 shows the renotching complete at the front termination. The piano, a 1923 Steinway M with a good soundboard, came into the shop for a new pinblock and strings with the provison that if I didn't like the looks of the bridge after unstringing I retained the option of renotching for an additional charge. I already knew from my initial inspection of the piano that recapping wasn't necessary. Notice that the bridge top has not been regraphited, that the string cuts have not been removed, and that the rear pins have not been pulled. We'll get to these considerations next time as the discussion continues.

Beyond the mechanics of renotching there is also a cosmetic benefit. Small cracks at the base of the pin can often times be partially or completely excised in the process. Fresh wood is exposed and the entire notch, from pins to the edge of the bridge, radiates with newness. To finish take a small brush and lay in some shellac followed by gloss varnish; add in the reddish-brown hues of new pins against a newly blackened and burnished top, and you will, after the fashion of Professor Higgins, be delighted at having molded a grimy and inarticulate lump into something respectable.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## SOUND BACKGROUND

# The History Of Taylor's Formula

Jack Greenfield
Chicago Chapter

### Taylor's Law Confirms Mersenne's Observations

Mersenne's laws of vibrating strings give the relationship between frequency and length, tension, and mass he observed in experiments. While he first published these studies in 1636, no plausible theory explaining the motion and the mathematical basis for the calculation of frequency appeared until after the end of the 17th century. In the final decades of the century however, the better understanding of the principles of mechanics and the advanced mathematical techniques resulting from the work of Newton and other physicists paved the way for the progress of acoustics in the 18th century.

The English mathematician Brook Taylor (1688-1731) was the first scholar who conceived a mathematical theory of wave motion based on Newtonian physics. Although his analysis does not fully cover all important details of string motion, Taylor's formula stating the relationship between string vibration and length, tension, and mass became very useful in later research on pitch as well as in practical keyboard instrument applications.

### Taylor's Education And Independent Research

Taylor was a member of a fairly well-to-do family of minor English nobility. He grew up in an environment of music and art in a home where prominent musicians were frequent guests. He showed a talent for music at an early age. His education included study in mathematics at St. John's College, Cambridge, where he received an LL.B degree in 1709 and an LL.D degree in 1714. After leaving Cambridge, he held no university position. His family wealth enabled him to devote himself entirely to independent scholarly activities, which were primarily in mathematics and to a lesser extent in music and art.

Taylor became a member of the Royal Society of London in 1712. He served as its secretary from January 1714 to October 1718. Much of his work is discussed in his articles, letters, and reviews that appeared in the "Philosophical Transactions Of The Royal Society" published for the years 1712-1724. He also wrote several books. He and Newton, whom he admired enthusiastically, were good friends. Taylor knew and corresponded with many other eminent mathematicians and philosophers as well.

Taylor's best-known achievement in mathematics was his presentation of the mathematical process known as Taylor's Theorem. The Taylor series formula stated by this theorem is still applied in current mathematical research as well as in applications of mathematics to science and engineering. Taylor also made major contributions to art — with two books on perspective, and to musical acoustics — with his paper on the motion of vibrating strings.

### Publication Of Taylor's Theory Of Vibrating Strings

Taylor's research on vibrating strings allowed him to combine his love of music with his talent for mathematics. He began this study early in his career. In 1713, he presented his paper written in Latin "De motu nervi tensi" ("Concerning The Motion Of A Stretched String") to the Royal Society. It appeared in the "Philosophical Transactions" in 1714, and again in a book on mathematics Taylor published in 1715. In the derivation of his vibrating string formula, Taylor assumed that the string vibrated in a single transverse mode, the mode which became known as the fundamental mode. Through a series of steps in geometric reasoning and use of a Newton equation of motion, Taylor demonstrated that the effects of the forces acting on a plucked string under tension will cause it to vibrate in the manner of a pendulum whose period of oscillation is independent of amplitude. Reasoning further from Newton's mathematics of the motion of a pendulum, Taylor derived a formula for a pendulum isochronous (oscillating at the same rate) with the vibrating string. From this he obtained his final equation for frequency:

number of vibrations per second = $\pi(PD/NL)^{1/2}$

As shown in Lindsay's translation, P = tension force stretching the string, usually represented as T in modern nomenclature; D = length of a simple pendulum with a period of one second; N = weight of the string; and L = length of the stretched string.

### Modern Form Of Taylor's Formula

In a simplified modern version of Taylor's formula, N is replaced by L m g, where m is mass per unit length and g is the gravity acceleration constant. D is obtained from the formula for a simple pendulum: Period = $2\pi(D/g)^{1/2}$ for a one second period; $D=g/4\pi^2$. Substitution of the preceding terms into Taylor's original formula gives the following equation:

frequency (f) = $(T \times g/mgL \times 4\pi 2L)^{1/2}$
$= \pi(T/4\pi^2 mL^2)^{1/2} = 1/2L(T/m)^{1/2}$

Taylor's formula is in agreement with Mersenne's observations that the frequency of vibrating strings is: 1. inversely proportional to the length, 2. directly proportional to the square root of the tension, and 3. inversely proportional to the square root of the mass per unit length.

## Taylor's Later Years

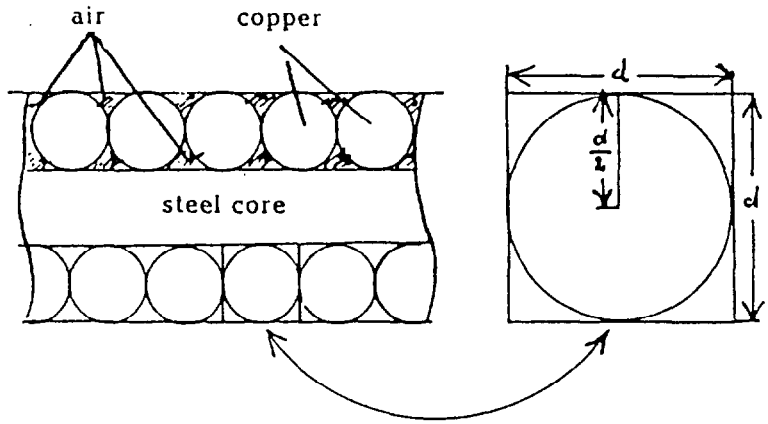
Taylor did not continue with any further studies on vibrating strings. Troubled with poor health, after giving up his post as secretary of the Royal Society in 1718, he reduced his scholarly activities. He wrote several papers later on music theory but these concerned harmony and composition rather than musical acoustics. In his final years, he wrote on philosophy and religion.

## Taylor's Formula Used In 19th Century Research

While equations developed later in the 18th century described the complex vibrations more adequately, Taylor's formula was found more convenient for simple calculation of frequency. It was used for this purpose in research on pitch after the middle of the 19th century. In a chapter on the transverse vibrations of strings in Book I, "The Theory of Sound," by J.W.S. Rayleigh first published in 1877, the author discusses experiments in which the physicist A. Seebeck used Taylor's formula to calculate the pitch of strings suspended vertically and stretched by measured weights. Seebeck's results were accurate. The appendix written by Alexander J. Ellis for his 1885 translation of the fourth edition of "On The Sensations of Tone," by Helmholtz contains Ellis's account of tests in which a formula that appears to be a logarithmic version of Taylor's formula was used to calculate frequency. In 1885, Ellis and Alfred J. Hipkins of Broadwood had conducted a series of tests in which the calculated pitch of tones from a monochord was checked with a set of 19 accurate tuning forks covering a range of 223.77 to 578.40 vibrations per second. Ellis observed that the errors in pitch calculation were as high as five vibrations per second.

## Introduction Of Taylor's Formula For Piano Scaling

Presumably, Hipkins may have used Taylor's formula in his work on scaling pianos as chief technician for Broadwood. Taylor's formula in another form was introduced to the piano industry of the United States in a 1914 publication of the American Steel and Wire Company. An earlier reference, "The Theory and Practise of Piano Construction," by William B. White, published here in 1905, gives empirical instructions for piano scaling but does not include the Taylor formula. The American Steel and Wire formula later became known as the Klepac formula, being named for Joseph Klepac, a technical authority who was a member of the firm. With known frequency (f) in vibrations per second, measured length (L) in inches, and weight (W) in grains per inch of length taken from an American Steel and Wire table, the formula gives the tension (T) in pounds:




$$T = f^2L^2W/675356$$

A more recent modification of Taylor's formula that uses figures for string diameter instead of weight in grains per inch is derived as follows:

1. Taylor's formula in the form $f = 1/2\ L(T/m)1^{/2}$ rearranged to solve for tension:

$$T = 4f^2L^2m$$

2. The weight per unit length of wire = cross section area x density (s) of steel wire:

$$W = \pi(d/2)^2s = \pi d^2s/4$$

3. Mass (m) = weight/gravity acceleration constant or W/g. By substitution for W indicated in step 2:

$$m = \pi d^2s/4g$$

4. Substituting for m as indicated in step 3, in the formula for tension T in step 1 gives:

$$T = f^2L^2\pi d^2s/g = (\pi s/g)f^2l^2d^2$$

5. Further simplification by combining $\pi$, s and g into a single constant gives the formula:

$$T = K\ f^2L^2\ d^2.$$

Following are the figures for the calculation of the specific constants for steel wire in conventional U.S. and in metric units:

$K(U.S.) = 3.1416 \times (.2831b/in^3)/(386in/sec^2) = .00230$

$K(metric) = 3.1416 \times (7.85gm/cm^3)/(981cm/sec^2) = .0251$

$T(lb) = .00230f^2L^2d^2$ with L and d in inches

$T(gm) = .0251f^2L^2d^2$ with L and d in centimeters

In the International System of Units (SI) the unit of tension is the Newton (N) instead of the gram or kilogram. Following are factors for conversion to Newtons:

1 kilogram = 9.81 Newtons, 1 lb. = 4.45 Newtons.

## Modification Of Taylor's Formula For Wound Strings

Although problems in scaling of wound strings were discussed at the 1916-1919 Piano Technicians' Conferences sponsored by the American Steel and Wire Company, it does not appear that a suitable simple formula for determining wound string tension was presented until decades later. During the 1960s and since then, several different formulas have appeared in the *Piano Technician's Journal*, each derived in a slightly different manner although similar in general principles.

The mathematical steps in modification of the solid string tension formulas for use with wound strings include the determination of correction factors for air space and dissimilar metals in the winding, and the alteration of the formulas to reflect the additional weight of the winding. The correction factor for air space is the value of the ratio of space occupied by a spiral wrap to the space filled by a solid cylinder. Looking at the wound wire from the side perpendicular to its length, the cross section of a single wire can be considered as a circle inscribed in the square space that would be occupied in a solid cylinder. The ratio of the circular cross section of the wire, to the area of the square, is an approximation of the fraction of the space occupied by the wire winding. Since the length of each side of the square equals the diameter of the square, the ratio of the circular area to the square is:

$\pi$ (diameter/2)$^2$ to (diameter)$^2$ =

$.785d^2/d^2 = .785$

Multiplying the density of the metal in the winding by the factor .785 gives a value for the average density for metal and air space in the winding. The specific figures for copper windings are as follows:

$.321\ lb/in^3 \times .785 = .252\ lb/in^3$

$8.94\ gm/cc^3 \times .785 = 7.02\ gm/cc^3$

The correction factor for converting the density of the copper winding to its equivalent weight in steel is determined from the ratio of the densities of the metals:

copper winding/steel wire = $(.2521b/in^3)/(.2831b/in^3) = .89$

The figure is the same for densities in metric units.

The weight per unit length of a cylindrical copper winding with density .89s and inner and outer diameters D and d can now be expressed as:

$$\pi D^2(.89s)/4 - \pi d^2(.89s)/4$$

Adding the weight of the winding as shown above to the weight of the core wire as determined in step 2 gives the following equation for the weight per unit length of string with copper winding:

$$W = \pi D^2(.89s)/4 - \pi d^2(.89s)/4 + \pi d^2 s/4$$
$$= \pi s(.89D^2 + .11d^2)/4$$

Replacing the $d^2$ of the tension formula for unwound strings with $(.89D^2 + .11d^2)$ gives the following tension formulas for strings with copper windings in conventional U.S. and metric units:

$$T(lb) = .00230f^2L^2(.89D^2 + .11d^2)$$
$$T(gm) = 0251f^2L^2(.89D^2 + .11d^2)$$

The error introduced by the lack of winding near each end of the speaking length is not considered significant.

## Accuracy Of Taylor's Formula

Taylor's formula was based on the theoretical physical properties of the "ideal" string. In reality, stiffness, impurities, and irregularities and transfer of energy to the soundboard are factors not considered in the formula. Even though not precise values, the figures obtained do give an indication of the changes in tension from note-to-note for checking on the cause of unevenness in tone quality. The use of tension calculations in scaling is discussed in references on the subject.≡

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| **Mar. 29-<br>Apr. 1, 1990** | **Pennsylvania State Convention**<br>Warrendale Sheraton Hotel<br>Contact: David Barr, 524 Jones Street, Verona, PA 15147 (412) 828-1538 |
| **April 3-5, 1990** | **Pacific Northwest Conference**<br>Cavanaugh's Inn at the Park, Spokane, WA<br>Contact: Scott Colwes, 1315 Coeur D'Alene Avenue, Coeur D'Alene, ID 83814 (208) 667-3393 |
| **April 7, 1990** | **East Tennessee One-Day Seminar**<br>Heritage Music, Inc., 7212 Kingston Pike, Knoxville, TN<br>Contact: Tom E. Graves, 228 Hillcrest Drive, Knoxville, TN 37918 (615) 688-0916 |
| **Apr. 20-22, 1990** | **Michigan State Conference**<br>Lansing, MI<br>Contact: Karen-Jane Henry, 1633 Minoka Trail, Okemos, MI 48864 (517) 349-5030 |
| **Apr.26-29, 1990** | **NELCRO Seminar**<br>Hotel Auberge Des Gouverneurs, Québec, Canada<br>Contact: Roland Bessette, C.P. 364 SNCC, Brossard, Québec, J4Z 3N3 Canada,<br>(514) 444-1135 or (514) 465-8076 |
| **Apr. 26-29, 1990** | **Central West Regional Seminar**<br>Henry the 8th Hotel, St. Louis, MO<br>Contact: Liz Baker, 4136 Botanical, St. Louis, MO 63110 (314) 664-4914 |
| **May 18-19, 1990** | **Intermountain Seminar**<br>Provo, UT<br>Contact: Jack Reeves, 486 N. 300 W., Orem, UT 84057 (801) 225-1757 |
| **July 7-11, 1990** | **33rd Annual PTG Convention & Technical Institute**<br>Hyatt Regency Dallas at Reunion<br>Contact: Piano Technicians Guild, Inc., 4510 Belleview, Suite 100, Kansas City, MO 64111<br>(816) 753-7747 |


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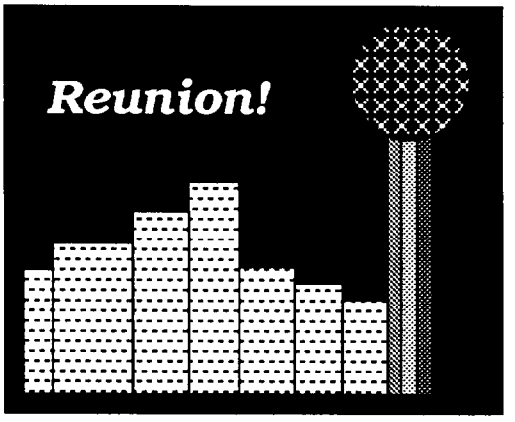
## President's Message
### Agnes Huether

The December 1989 *Newsletter* had an account by our "Reporter At Large," Charles Huether, who described our 1990 PTG Convention hotel, the Hyatt Regency as one of the newest hotels in an ultra-modern city, with elegant features to enhance our Auxiliary programs. It will be an exciting and memorable occasion.

"The hotel is the most recognized landmark in Dallas — a city symbol known around the globe. Soaring 50 stories above pavement and prairie, Reunion Tower stands tall even by Texas standards. It's the world's most awesome signpost for one of the world's great hotels... Hotel Hyatt Regency Dallas." These three sentences are found in the hotel's publicity brochure and you must come to Dallas to view the tower and see if the 18-story atrium is really breathtaking!

Dallas is often referred to as "Big D," even "Cowtown" and who has not heard of "Deep In The Heart Of Texas?" But these names are of fairly recent origin. Dallas is a very young city. Compare it to "oldsters" like St. Louis, Philadelphia, Boston, Chicago and New York, and it is an infant! Of course as a "youngster" it offers some of the most interesting and




diversified attractions and entertainment to be found anywhere. Dallas wants you to sit up and take notice of it! Spending a week in the Dallas/Fort Worth area, one can get to only a few of the marvelous and exciting places the city has to offer.

We have made every effort to offer a jewel-packed program of events. There will be our usual "Get Acquainted" coffee and pastry prior to our annual Council, our Auxiliary Tea where it is expected our scholarship winners will entertain at the keyboard, our Installation Luncheon and of course our optional tour of Dallas. This bus tour of the city will provide an overview of Old City Park, the Kennedy Memorial, Thanksgiving Square, Dallas Market Center, the Morton Meyerson Symphony Hall (designed by I.M. Pei) and much, much more. There will be ample time to browse, shop and lunch before we progress on to the Dallas Repertory Theater for a road-show engagement of Broadway hits.

There will be more up-to-date information on the theater presentation after mid-April when acting contracts are confirmed. Look for details in the June issue of the Auxiliary Exchange.

Come and join us for a complete package of piano-related classes and unique entertainment events. Meet new members, renew your acquaintance with long-term members, exchange news of family and friends at congenial gatherings of individuals who enjoy a common interest in the world of music.

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## From The Editor's Mailbag ...

Several weeks after our July 1989 convention, we received a delightful letter from *Dorothea Odenheimer* which summarized the events enjoyed by the Auxiliary and recounted her impressions of a most successful convention. Doro's 1 1/2-page account is being edited, but several highlights will be cited as a way of informing those who did not attend that they missed a great time and had better make immediate plans for Dallas.

The city tour which provided an overview, the Forest Center with its gift shop featuring many items of myrtle wood, the Rose Garden with one of its flowers named after Picasso and the view from the Pittock Mansion, all received high praise from our Van Nuys, CA, resident and world traveler.

The ample salad luncheon at the Charter House, minus desert(!), came in for honorable mention. There were some who ached for ice cream! This full day out of the convention hotel will be offered again next July 7-11 in Dallas.

Dorothea also found great interest in *Nita Kadwell's* descriptions of art and antique glass, the "fashions" in glass and the features that make special pieces particularly valuable. Doro was just a mite disappointed not to have won the cut-glass bowl that was raffled off at the Auxiliary Luncheon. There was an unusual aspect to the luncheon. A fashion show was presented by Native Americans from Western and Northwestern Tribes, both young and old were innovative, well received and afforded a modest contribution to the Indian Federation of America. Thank you, Dorothea, for your letter and its review of the 1989 Convention.

In mid-January, Dorothea wrote again to comment on and express how much she enjoyed reading *L. Paul Cook's* account of his trip to Asia. Only Doro wrote to tell us! She also described the Christmas dinner and social of the Los Angeles Chapter of the Auxiliary. They have met and dined at the same restaurant for the past seven years and there was a unanimous vote to meet again next year! The program at the restaurant included a story reading by *Sarah Lampiasi*, a mini-presentation of songs and stories by Charles Dickens and his wife, played by Mallory and Jan Geller of the Piano Technicians Guild. Jan provided background music on her small celesta. There were gifts for all — small jewelry boxes wrapped in festive paper for the women and candy canes for the men.

Without your letter, Dorothea, we never would have learned of the Los Angeles Auxiliary activities. Many thanks to you.

There was an account of the Yuletide festivities enjoyed by *Janet Blees* and her family. The Blees' have been very busy with Bell Choir, holiday entertaining and completing deadlines for piano service.

*Ginny Russell* capped her Christmas celebrations with a flight to Phoenix, AZ, where she toured that city and environs as well as spending 10 days visiting with relatives and friends. After a good rest Ginny is back teaching piano theory and performance.

*Julie Berry* and spouse Ron sojourned in Florida visiting maternal grandparents and auntie with the boys Charlie and Daniel. Julie wrote that Daniel gave his aunt quite a scare when he hid in a carport while under her care, and she feared he had fallen into the canal. Was that the intercoastal one, home of the manatees?

A note from *Barbara Fandrich* told us she spent Thanksgiving in Seattle so she could see husband Del, who was working on a project in the Northwest. She wrote that they expect to put their Arkansas home on the market shortly, and plan to relocate to Oregon in March or April.

*Ginger Bryant* wrote to advise that the winners of the Auxiliary Scholarships reside in Houston and San Antonio. She is doing her best to get the young men to come to Dallas in July to play for us at the tea. In a future issue Ginger will provide a full report on the Scholarship winners and future plans.

Word from *Nita Kadwell* is not good. While she and Ken are in good health, they have been wrestling with the problem of severe floods and mud slides in their region of Onalaska, WA. There is much work to be done as far as cleanup, restoration, etc., and she has reservations about whether or not they will be able to get to Dallas. Nita still has Cookbooks for sale, and is eager to remind one and all that they will make great shower gifts for June brides.

*Editor*

**7 —11**

**DON'T FORGET:**

In 1990 in the seventh month, the Annual Convention takes place from the seventh to the 11th of July!

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