PIANO TECHNICIANS
Journal
Official Publication of the Piano Technicians Guild

July 1995 Vol. 38 • #7

Inside:

Tickling the Ivories — An In-depth Look At a Key Element of the Piano

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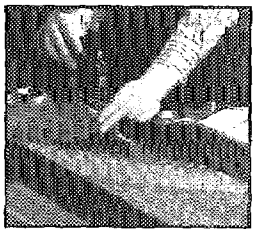

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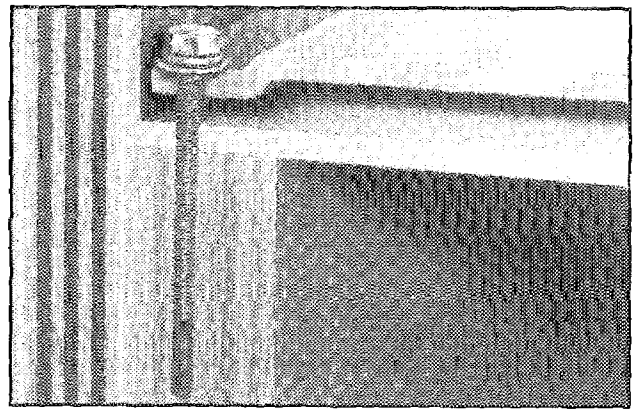

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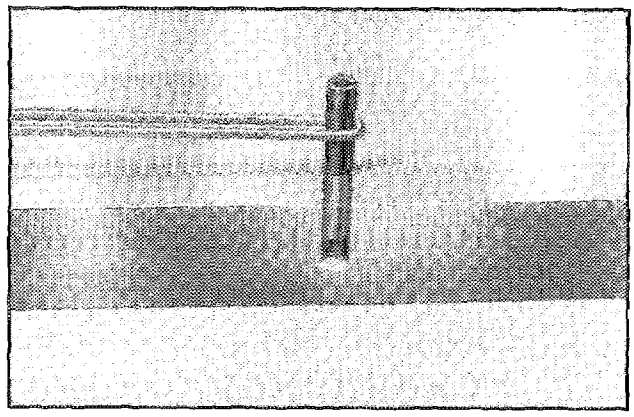

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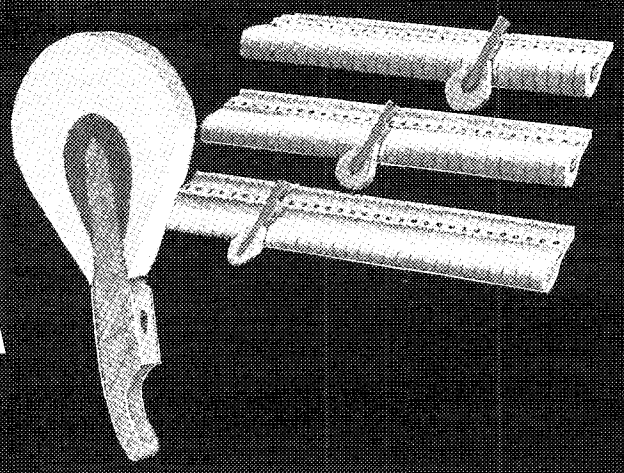

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Editorial Perspective

Where the Finger Meets the Key

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

How many times a year do we hear the expression "tickling the ivories" as a metaphor for playing the piano? Mention ebony and ivory in the same breath, and everyone knows you're talking about either racial equality or a piano keyboard. Ivory is still associated with pianos even though, as David Shayt mentions in our lead article, its use in keyboards has been "politically obsolete" for some six years now, and "industrially obsolete" for about 30 years longer than that.

It is partly because of that very obsolescence that ivory holds a certain fascination for pianists and technicians alike. It is because we can no longer obtain new supplies of this remarkable material that we as technicians face the special task of learning the methods of ivory conservation and restoration. We also need to be current about alternative materials with similar properties, such as bone keytops and synthetic ivory.

For these reasons, I felt that the subject of ivory — its history, its properties, and the ways we can keep old ivories on the job as long as possible — would make a fitting topic for this first "theme" issue of the *Piano Technicians Journal.* We get many requests for information on ivory restoration techniques, and this issue includes articles on many of these methods. The theme approach, although rarely feasible, allows us to create a ready reference on a given topic, looking at the same topic from a number of viewpoints, from the philosophical to the practical. I hope to be able to bring material on other subjects together in this way as often as once or twice a year.

Another "first" (as far as I know), is the inclusion of a major article from an author who is not a piano technician, and who in fact does not work with pianos in any way. He is David H. Shayt, an employee of the Smithsonian Institution's National Museum of American History. He cares for handcrafted collections and their tools, and his other research interests include leather-glove making, diamond-cleaving and pearl button manufacture. Shayt's article in this issue takes a detailed look at the American ivory industry, especially as it relates to pianos. The article appeared originally in the *Journal of the Society for Industrial Archeology*, in 1993, and is reprinted here with the kind permission of the author.

■ ■ ■

I hope you enjoy the new department making its debut in this issue: "Grand Illusions: The Page for Serious Cases."

■ ■ ■

Send letters to the editor, articles, questions, tips, etc., to me at: 205 McGraw Street, Seattle, Wash., 98109, or, E-mail: sbrady@u.washington.edu, or, FAX: (206) 285-7610.

■ ■ ■

See you in Albuquerque!

PIANO TECHNICIANS
Journal
Volume 38 • Number 7 • July 1995

COLUMNS & COMMENTS

DEPARTMENTS

IN ADDITION

FEATURES

PACE
Professionals Advance through Continuing Education
LESSON PLAN

COVER ART

Master craftsman Bill Smith's miniature piano is made from eight old ivories and measures only 35 mm long and 20 mm wide.

A Time for Reflection, A Time of Changes

PTG President
Leon Speir, RPT

This issue of the *Journal* marks the end of the 1994-95 Council year and the beginning of the 1995-96 year. I suppose anyone who has occupied the office of president chooses this time of the year to reflect on the accomplishments of the previous year and look forward to needs for the coming year. This month I'll share some of my thoughts with you.

Changes to the *Journal* have highlighted the accomplishments for this past year. The 1994 Council took clear action to identify the *Journal* as the most important member benefit. Based on this Council's directive the board then acted to restructure the *Journal* and to select Steve Brady as *Journal* editor. Steve's work has met and exceeded our expectations. His enthusiasm for his work and his skill is clearly evident with the quality and content we now see in the *Journal*. Also Joe Zeman was added to the Home Office staff as Director of Communications to aid Steve and Larry in compiling the *Journal*. Producing a monthly magazine is a big job and I applaud everyone involved.

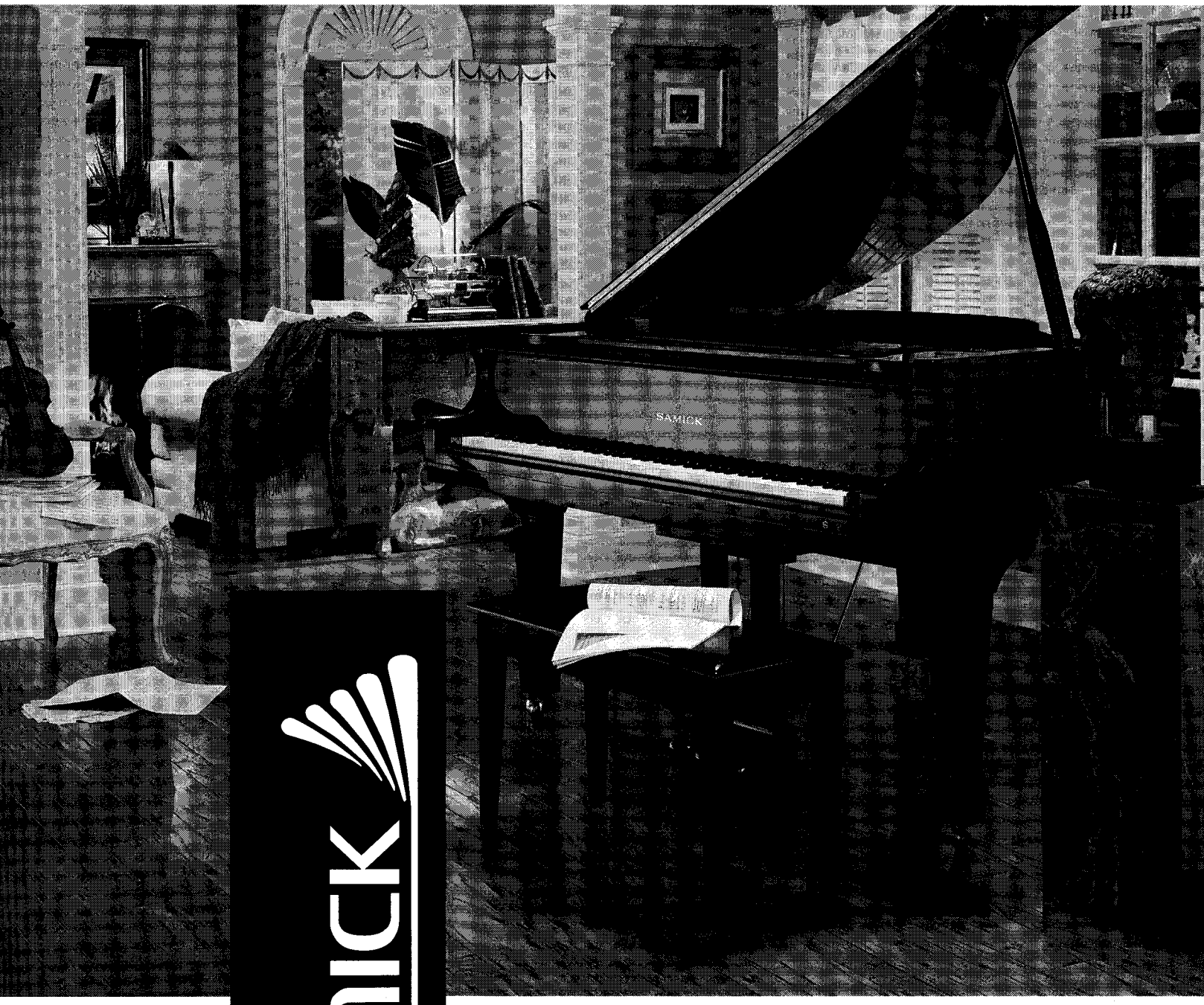
Recognizing that long range planning is key to the success of any organization or business, the Board took action in January to begin working on a five-year plan for PTG. Requests for proposals have been sent to several individuals and firms who are skilled in providing assistance in long-range planning for non-profit organizations. Although a professional may aid in the planning process, PTG has a rich tradition of being a member-driven organization, and long-range planning must be guided by members. This will be accomplished by selection of member groups to advise our professional planner and the Board during the planning process. After goals are evaluated and priorities are suggested, Council will then make the final decisions. Structured long-range planning is long overdue for PTG. Hopefully, a long-range planning proposal will be finalized for consideration by Council next year.

A Vertical Regulation curriculum has been finalized by PTG and will be available this month. Development of this course came as a direct response to the 1993 and 1994 Council action on educational goals. A test run of this course at Santa Cruz University in December 1994 met with overwhelming success by both the teachers and participants. LaRoy Edwards, Fern Henry, and Bill Spurlock are to be commended on their untiring work to bring this project to fruition.

The RPT Exam program has shown an encouraging reversal in Associate reclassifications this past year. Hopefully, this trend will continue as more chapters integrate PACE programs in their offerings. Mitch Kiel, chairman of the ETS Committee, has written an outstanding Exam Pre-Screening Manual. Voluntary pre-screening will save time for both examiners and examinees by pre-qualifying Associates prior to the exam being administered. Although there has been a significant turnaround from the decline in Associate reclassifications of previous years, we must continue to work to streamline the RPT exam program and to encourage more Associates to reclassify to RPT.

Overall, this has been a very good year for PTG. Thanks to everyone who has volunteered their time to PTG and to our professional Home Office Staff on whom we rely so much.

Leon Speir



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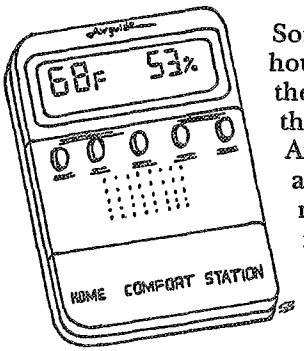
Tips, Tools & Techniques

TT&T *Hygrometer/Thermometers*

I've been meaning for some time to write something about one of my favorite tools. This is a digital, solid-state, hygrometer/thermometer (humidity/temperature gauge) which I've been carrying for better than a year now. It is 5.7" long, 1.2" wide, and 0.6" thick, and is equipped with a clip to allow carrying in a shirt pocket or belt (which I don't do, but could). This gauge is extremely handy and actually fits unobtrusively in my tool case. I use a Genck case (from Schaff) for tools and Accu-Tuner, and the gauge, in its carrying case, fits neatly above the Accu-Tuner keyboard and just below the removable tool pallet. I have had different attache-type cases and have carried a variety of temperature/humidity gauges in them but was always unsatisfied with the bulkiness and/or fragility of the gauges. This one is small, light, easy to read, and the batteries last for half a year or better. As its bottom is slightly rounded, and it keeps falling over when placed on the top of the pinblock, struts, etc., I attach it via two small Velcro buttons to the top of my Accu-Tuner. This gives me (and my clients) even more to look at, whether I'm watching the lights or tuning aurally. The gauge reads temperature in either Fahrenheit or Celsius scales and tracks minimum and maximum readings in both temperature and humidity and lists for under $50. It is carried by Markson, a scientific supply company with a catalog (free) well worth having even if only to browse through. Their phone is 1-800-528-5114. Markson also offers a variety of similar gauges, both digital and analog, at competitive prices. Jensen Tools, now a division of Stanley, also has a neat (free) catalog, and also offers the gauge for a slightly higher price. The index lists only one hygrometer/thermometer on page 110, but that's the analog Airguide. This one is on page 90 (the index calls it just a thermometer). Jensen's phone is 1-800-426-1194.

— Alan Crane, RPT

TT&T *From Ken Sloane, RPT*



Some (all?) of the piano supply houses and Radio Shack offer digital thermo/hygrometers at lower prices than those quoted by Alan. The Airguide model from Pianotek has a memory that saves maximum and minimum temperature and humidity levels. This is a handy feature for college and university technicians who may be wondering about the environment for their pianos over an extended period of time. I never leave home without mine!

TT&T *From Dennis Johnson, RPT*

I think that it needs to be emphasized that while these digital hygrometers are very convenient and can be reasonably accurate, they must be periodically calibrated. The problem though, with this self-evident realization, is that, at least on mine, this is not easy. I use the $150.00 DH100 model from Pacer Industries in Chippewa Falls, Wis., (and is also sold by Pianotek). The company strongly recommends sending it in once a year for service and recalibration which costs $40. I had the company send me the calibration instructions because as new it was reading about seven percent to eight percent too dry, and the instructions are rather involved. The unit is to be set on the shelf of a closed glass container filled with saturated solutions simulating the high and low limits. The low limit is set by a solution of distilled water and Potassium-acetate, the high limit uses a similar procedure with a solution of distilled water and Ammonium Sulphate. The instructions recommended using a potentiometer (whatever that is) to set these indications for high and low settings. I just sent it in.

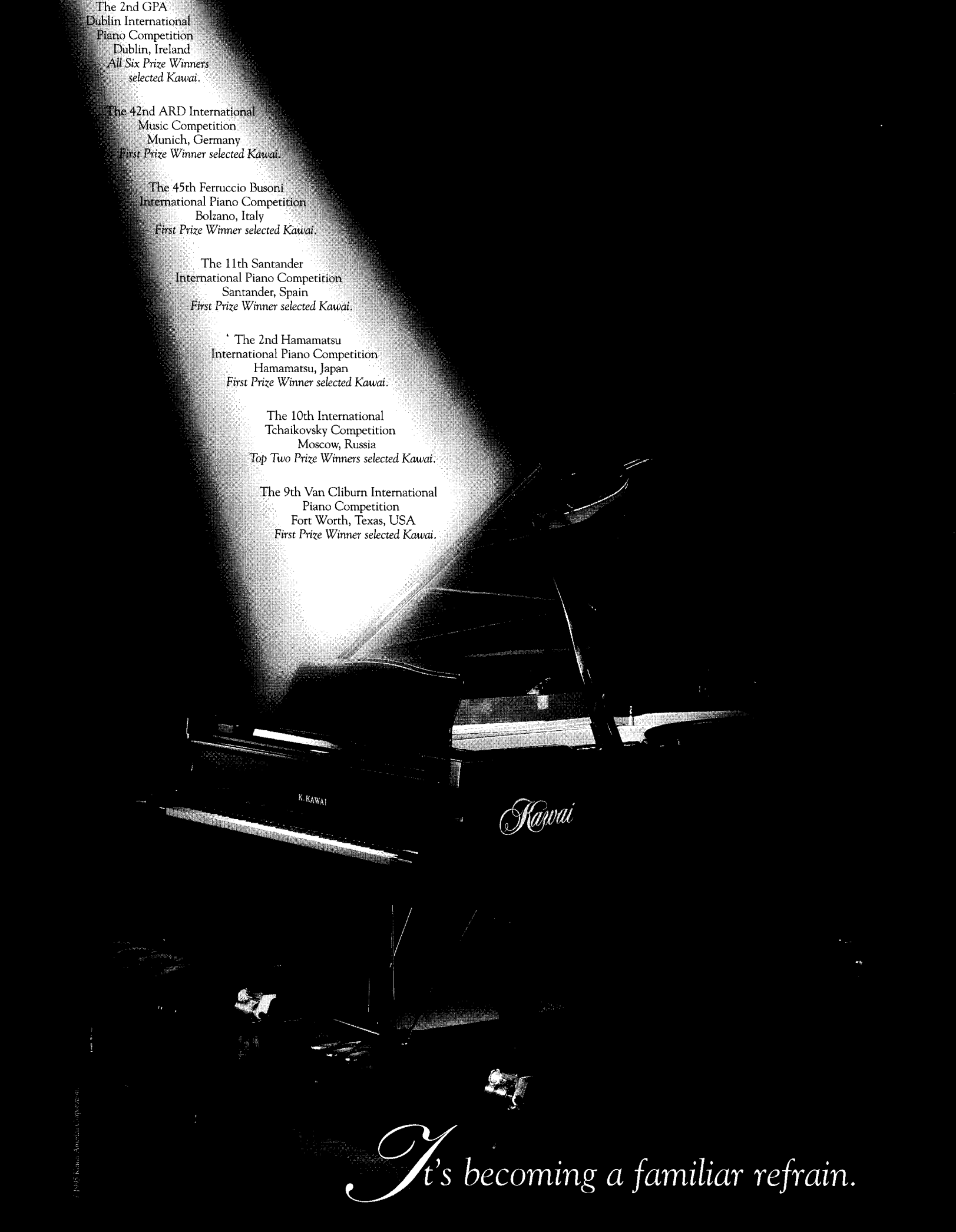
Another way around this is to have a good sling psychrometer available to monitor the accuracy of the meter. In this way it can still serve as a reliable gauge for a somewhat longer period. However, also note that slings (our reliable standard) also vary. The most likely explanation for this is that the inexpensive slings, the type most of us have, have no reservoir for the wick to remain moist while slinging. Consequently, as we sling, the wick is drying out and will on average read about five percent to seven percent dryer than a sling with a water reservoir for the wick.

Another problem with the digital units is that the wider the high and low limits are set during calibration, the less accurate that particular unit will be throughout its range. In some lab settings, where accuracy is critical, these units are set to read only a five percent to 10 percent range. I chose the DH100 because I felt it was more accurate, even over its wider range, than the less expensive alternative. Also, the school offered to pay for it. I compare them in some ways to the SAT. They are convenient and can save time, reliable when used with verification, and are certainly here to stay, but they do not and cannot replace the traditional manual methods.

Just a few things to keep in mind.

Continued on Page 12

Editor's Note: All of this month's TT&T contributions were taken from the "pianotech" Internet group.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The 11th Santander
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Santander, Spain
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The 2nd Hamamatsu
International Piano Competition
Hamamatsu, Japan
First Prize Winner selected Kawai.
The 10th International
Tchaikovsky Competition
Moscow, Russia
Top Two Prize Winners selected Kawai.
The 9th Van Cliburn International
Piano Competition
Fort Worth, Texas, USA
First Prize Winner selected Kawai.
K. KAWAI
Kawai
It's becoming a familiar refrain.

Continued from Page 10

TT&T *From Don Rose, RPT*

As Dennis points out, some of the small humidity gauges have very wide limits on their accuracy. Some are +/- seven percent for ranges below 40 percent. I recommend a gauge available from Edmunds Scientific Catalogue, number B37,352. Accuracy over the range from 10 to 90 percent is +/- two percent, and it will measure zero percent to 10 percent (+/-five percent) and 90 percent to 100 percent (+/-five percent). The cost is reasonable at $64.95 in U.S. dollars. It uses a measuring probe so it could be placed in an easy-to-view location while tuning. Response time is three to five minutes, so decisions about whether to "float" the pitch or do pitch correction can be made with little time wasted. Wal-Mart is selling a Bionaire temperature and humidity gauge for $20 Canadian! At this price every tech should have one.

TT&T *From John Minor, RPT*

I don't know what all the fuss is about accuracy of humidity gauges. The owners manual with my Bacharach (No, NOT Burt!) Sling Psychrometer says:

"In addition to the above instructions, barometric pressure and other factors will influence exact relative humidity determinations to a very minor degree. For precise work, use psychometric chart or set of table such as W.B. 235 'Psychrometric Tables for Obtaining the Vapor Pressure, Relative Humidity, and Temperature of the Dew Point' which can be purchased from Superintendent of Documents, U.S. Govt. Printing Office. However, accuracy of the psychrometer is satisfactory for all except the most exacting work."

For our type of work, it's only really necessary to have an approximate humidity reading. After all, it will change with the temperature!

This reminds me of the first time I owned a decent watch, with a quartz crystal. I had access to the railroad phone number with ACCURATE time. It said: "At the tone 4 hours 22 minutes, coordinated universal time." I took it to the jewelers and told them it gained time. They asked how much time, and I told them 1.5 seconds a month! I could tell by the expression on the jeweler's face I was in for a long and frustrating career as a "perfectionist!"

TT&T *From Kent Swafford, RPT*

I have seen Alan Crane's hygrometer installed atop his Accu-Tuner; this would be a useful configuration and probably worth the extra money that he paid to get this miniature device. I have a Radio Shack hygrometer installed in the lid of my small Accu-Tuner case, and still sometimes forget to record the readings. Atop the SAT would be more convenient. (By the way, I think this has been mentioned here, but Radio Shack may have discontinued their electronic thermometer/hygrometers.)

As to the accuracy of these devices, I think it is impractical to send these things in for regular calibration, especially if the calibration costs as much as a new device. Remember that these devices are not claimed to be very accurate in the first place. I say, round off all the readings to the nearest five percent, which should be sufficient for our purposes. Then, get a second device, either by buying one or bringing together a lot of the devices of various makes and models at a PTG meeting. Then, when the rounded-off readings don't agree, opt to buy a new one or get a calibration.

TT&T *From Dennis Johnson, RPT*

You and John Minor both have a valid point about not getting too anal-retentive about accuracy here, at least for our general purposes. Accuracy became an important issue for me here at school last winter when the department (meaning mostly myself) really pushed the problem of humidity control in our building with the physical plant, who controls the climate system. To make a long story short, in the end, they insisted that everything was fine and my readings just must be off. This went back and forth, but this winter it has been many times better. In spite of the mild winter I am giving them a little credit. I also think that my case as presented to them ultimately paled in comparison to the effect caused by the bills some faculty forwarded to them for repairs of split cellos and violins.

Anyway, most of the time reasonable accuracy is fine. However, I do maintain that, as authorities of piano care, we should be aware, and regularly check the accuracy of information we offer to clients. Plus or minus five percent R.H. really is a lot, and could mean the difference between having no problem, or having cause to get concerned.

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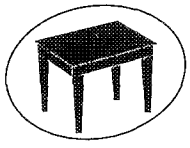

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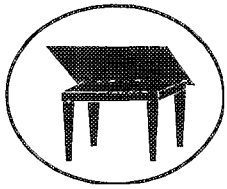

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Q — Bass String Storage

What's the best way to store sets of bass strings, hanging straight down, or wound up and tied in a circular shape?

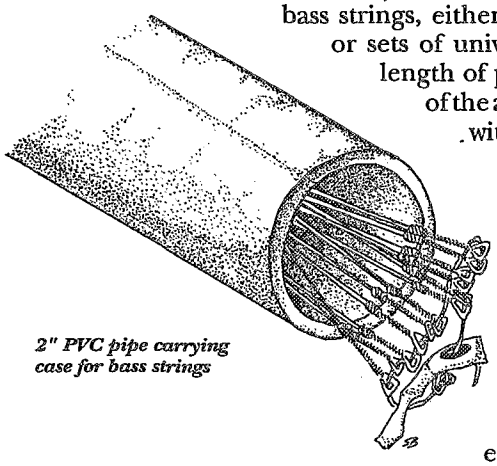
— Barbara Richmond, RPT

A — From Dale Probst, RPT

When I asked Bob Beck about this (I was concerned about storing them in my van) he said that hanging straight was superior to storing coiled. They ship coiled because it is cheaper. At one time, Mapes marketed a set of guitar strings called Nashville Straights whose main advantage was touted to be that they had never been coiled into small guitar string packages. I am not sure of the reasoning behind this. I have stored them both ways and find no practical difference except, like snakes, they are easier to handle when not coiled.

A — From Paul Dempsey

One way that I store and transport bass strings, either replacement sets or sets of universals, is to use a length of plastic pipe (PVC) of the appropriate length with a cap glued on one end and a removable (screw-on) cap on the other. Keeps everything clean and dry and untangled, it's easy to carry in my vehicle and it stands up on its end out of the way in the shop. I keep several, and when a shipment of strings arrives from the stringmaker I immediately take them out of the box and slip them into a pipe. The pipes are easily labeled.



2" PVC pipe carrying case for bass strings

A — From Allan Gilreath

My cases, similar to Paul's, are made of 3" PVC with a cap on one end and a "clean-out" on the other. They look like the long cases that surveyors use, are waterproof, can be custom cut for any length set and can have a pack of silica gel added for moisture absorption. This way I keep my strings organized, protected, straightened out, and unhung, all at the same time. Of course, keep them on the wire to maintain order.

A modification of this idea also works for storing strips of damper felt either in the shop or in the van. This size uses 2" PVC and allows usually 3 cases from a 10' length of pipe. A separate case for my straight edge, soundboard steel, etc., is made from the same material.

Q — Dry Rot in Pianos?

How does one identify wood dry rot? What are some of its characteristics? How does one go about ascertaining its presence?

— From Zen Reinhardt, RPT

A — From John Hartman, RPT

The term "dry rot" causes a great deal of misunderstanding and confusion. It commonly refers to one of the decay-producing fungi that attack dead and fallen trees, buildings and objects made of wood. Dry rot is a misleading term because, for any true fungal growth to occur, the wood must be damp. There are, however, a number of fungi that conduct moisture into the wood through tiny strands that pick up water from the surrounding soil or other moist areas. This is probably how the term "dry rot" started in the first place. The more accepted term is "water-conducting fungi."

When wood develops an advanced case of fungal decay, whether it's "dry rot" or another species of fungus, a number of indicators will be present. Either a white or a brown stain appearing on the wood's surface in combination with a marked deterioration of strength are reliable signs. The two types of

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fungal decay most likely found are brown rot and white rot. Brown rot produces a brown stain on the wood surface. Deterioration of the wood structure shows as cracks across as well as along the grain, a condition known as cubicle checking, giving the wood the appearance of a waffle iron. White rot stains the surface of the wood a whitish color. White rot samples do not show deterioration of the wood's structure as dramatically as brown rot. The surface can appear quite normal but the affected areas will have practically no structural integrity. In addition, fruiting bodies such as toadstools, brackets or crusts will develop in severe cases of most fungal decay.

The most likely places to find fungal decay is in the floor joists of old houses with damp basements, outdoor wood lots and the forest floor. A full-blown case is unlikely in a piano living in a habitable home. Wood must be damp for a sufficient time in order for decay to develop. The wood must have moisture in excess of its fiber saturation point, an average of 30 percent water by weight. In the home wood will stay well below this level, rarely if ever reaching 20 percent. Mildew and other molds are less serious fungi that can form white or brown discoloration similar in appearance to white or brown rot. They are the more likely causes of the white discoloration often found on the undersides of grands and the back posts of uprights. While these also require higher moisture levels, they can develop even if the surface becomes wet intermittently. Still, mildew rarely develops sufficiently in a home environment to damage the wood.

The subject of wood decay in the piano often raises the issue of other aspects of wood deterioration. The most often-asked question is what causes the loss of strength in old action parts? The dark brown color that develops in old action parts suggests to some that fungus or bacteria may be at work. Oxidation and other chemical reactions between the wood and atmospheric gasses are the true causes of this staining, as well as the patina on old furniture prized by collectors. Many technicians have noted a relationship between the degree of oxidation and the brittleness of action parts, suggesting a cause-and-effect relationship. Wood scientists have not yet studied the effects of oxidation on the strength of wood. This is probably because oxidation penetrates only the wood surface and does not have a significant effect on the relatively large wooden architectural elements which usually concern scientists.

An explanation often given for the brittleness of old action parts is that they become dryer and dryer with age. This explanation does not hold up to scientific scrutiny. We know that wood remains hygroscopic to the same degree throughout its life; it cannot become dryer simply by aging. It picks up moisture and dispels it in relation to the environment's relative humidity and the characteristics of the species of wood. While there may be some effect on the wood's reaction to moisture due to age or oxidation, the fact remains that most species are stronger in their dry state.

Another explanation for brittle action parts, one that I think is more plausible, is the gradual weakening of the wood due to repeated stressing over a prolonged period of time. Action parts become stressed and very slightly damaged during use. Minute damage to the wood cells can accumulate over a long period of time. This damage will naturally progress fastest where the parts are most stressed, for example, along the hammer shanks and inside the action centers where mechanical forces are greatest. In addition, wood parts can become damaged due to seasonal wood movement. A clear example of this is the damage to flanges often found in old actions. As the flange expands in high humidity it becomes trapped by the screw. In time, as the screws are tightened each year, the flanges become crushed and even cracked. Small stresses such as these can lead to wood cell damage and contribute to unexpected failure during normal use.

Q *Ivory Repair*

I have been recently asked to replace the damaged ivory key tops on a Chickering Quarter Grand with ivory key tops. Although I have reattached loose heads on many occasions with wafers, there are several questions I would like to ask about ivory key tops.

First, is there a way to bleach the ivory while still on the key without causing it to come off?

Second, what is the proper way (concentration and time) to bleach ivory?

Third, how can I eliminate the line between the head and tail piece? It is not obvious to the casual observer on factory installed ivory, but I can't get rid of it on ivories I install.

Finally, wafers work well for me, but I am curious if there is a better way to attach ivory to piano keys.

Any assistance you can provide in answering these questions will be welcome.

— Kenneth L. Raymond

A *Read on!*

This month's *Piano Technicians Journal* is devoted to ivory, its history, manufacture, repair, preservation and future.

Elephant Under Glass:
The Piano Key Bleach House of Deep River, Connecticut

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(Reprinted from The Journal of the Society for Industrial Archeology, *Vol. 19, No. 1, 1993)*

The American Ivory Industry

Prehistoric artisans carving with stone tools on the tusks of Ice Age mammals began a relationship with ivory that has continued almost to the present day. The sympathetic ways in which the large teeth of certain animals have interacted with cultural groups the world over and with cutting tools have produced over the last several thousand years a rarely interrupted flow of new artworks and utilitarian devices. Ivory's toughness, size, and radiance have distinguished it from bone, horn, shell, or any other natural substance and continue to defy replication by synthetics manufacturers.[1]

Ivory is a form of mineralized tissue called dentine, found in its purest states in the tusks or projecting front teeth of the elephant, the hippopotamus, the warthog, and the walrus. Other mammals such as the grizzly bear, sperm and killer whales, narwhal, and now-extinct sabertooth tiger, mammoth, and mastodon also have yielded up teeth to the ivory carver, chiefly for the creation of small works of religious or tribal importance. The durability of ivory and the ferocity of the animals from which it was taken have given ivory a special, almost spiritual, meaning to many pre-industrial cultures.[2]

In North America, walrus tusks and the teeth of sperm whales received the bulk of ivory working attention from North Atlantic and Arctic maritime communities. Carvers often left unaltered the original tusk or tooth profiles and oval cross-sections, restricting themselves to the incising or scrimshawing of thematic images into the outer surfaces. With few exceptions, such work was produced by self-taught folk artists associated with the hunting of whales and walrus, creating portable totems of the manly vanquishing of great beasts. This folk tradition reflects the historic symbolic uses of ivory as a trophy. Conversely, the American ivory working industry would look solely to the internal physical properties of ivory as raw material.[3]

Elephant tusks contain the most significant concentrations of workable ivory, both in cross-sectional area and in performance. Little record, however, exists of North Americans working either African or Asian elephant ivory prior to the 1790s, although slave ships were known to return from West Africa carrying tusks. New England traders in the West Indies, and later in Africa, obtained ivory when available, together with copra (a source of coconut oil), cloves, hides, copal (tree resin used as a varnish), and other precious African extractions.[4] The ivory carvers listed in 18th-century New York and Philadelphia business directories do not disclose whether their material derived from land or marine mammals. Regardless, markets and means of production in this luxury medium were insufficient to make the work in this period anything more than a specialty handcraft.

As with steel and other precious commodities, ships from Europe brought the first finished elephant-ivory combs, cutlery handles, walking sticks, and chessmen to the New World. And as with steel, American innovators persistently sought methods to mechanize sufficiently to seize the manufacturing advantage once reliable supplies of quality raw material could be secured.

Patents, business records, and local lore tell of the Pratt family, mill owners in the lower Connecticut River valley. They perfected waterpowered machinery in the early 19th century to cut the fine, needle-like teeth in ivory combs that were formerly cut by handsaw.[5] The factory manufacture of combs, clockworks, buckets, and numerous other specialty products had its origins in the hardwoods of New England forests. Located between major urban markets, the trade-centered villages of Connecticut and Massachusetts were thus well-positioned technologically to adapt to the slightly harder tusks, tortoise-shell, and brass plate when these uncommon but fashionable substances first became available in quantity.

The evident success of the Pratt comb-sawing enterprises helped transform the small mill villages around the port of Essex into the ivory working center of the continent. The logical preference to make commercial use of the full extent of a tusk's workable ivory spread production from combs to teething rings and other small notions to paper folders to billiard balls and to piano keys, exhibiting corresponding patterns of increasing mechanization and labor subdivision.[6]

Family dynasties of Pratts, Reads, Comstocks, and Cheneys arose in the region to dominate ivory factory ownership and the towns of Deep River and Ivoryton (figure 1). All local operations consolidated in 1936 when Ivoryton's Comstock-Cheney works merged with Deep River's Pratt-Read concern under the latter's more established name in the piano industry. Ivory working districts also flourished in lower Manhattan, Newark, and Buffalo, but the flowering of the industry took place in rural communities 30 miles north of New Haven, judging from the concentration of fully integrated factories, the regional profusion of ivoryworking patents, and the rise of an ivory culture among the townspeople.[7]

At the height of the trade (roughly 1850 to 1940), tusks would arrive in New York from ivory buyers stationed by American importing houses in London, Antwerp, or the East African ivory depots of Mombasa and Zanzibar. At their source, the companies relied on itinerant elephant hunters and local merchants for the stock, declining cracked and diseased tusks and buying by weight (figure 2). After additional grading in New York, tusk shipments were loaded on coastal schooners for the trip to Essex and then traveled by wagon to the factories (figure 3).

In a 28-year-period (1884-1911), over 4,900 tons of unworked elephant ivory entered the United States, principally to be machine-cut into small-instrument handles, measuring tools, billiard balls, and piano keys. Prices paid in New York varied from $1.80 to $4.00 per pound, depending on grade and availability. No more than four or five billiard balls could be turned from the average adult African tusk, while the same tusk might yield 50 to 55 complete piano keyboards, roughly 5,000 separate slips of ivory.[8]

The creamy ivory from the lesser

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The Piano Key Bleach House of Deep River, Connecticut

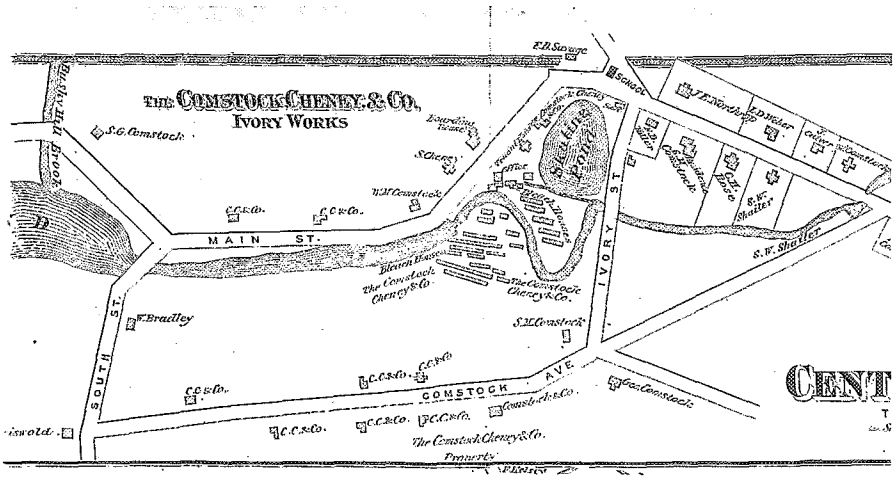

Figure 1. The company town of Ivoryton, Connecticut, looking north, 1860s. Note pervasive Comstock, Cheney presence and south-facing bleach houses. Detail from F.W. Beers, County Atlas of Middlesex, Connecticut (1867). Pratt-Read Records.

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tusks of the Asian male elephant was considered especially well-suited for small jewelry and game pieces, but the more plentiful African species — both male and female — produced the largest tusks at maturity. Lengths could reach 10 feet, with diameters up to eight inches. Regional variation across Africa also was considerable, as one German ivory manufacturer explained in a trade booklet distributed at the 1876 Centennial Exhibition in Philadelphia:

Soft or white ivory is the chief produce of Eastern Africa from Egypt down to the Cape. It is particularly well adapted for making combs, pianoforte keys and billiard balls. Hard or transparent ivory is nearly all imported from the West Coast of Africa, the Gaboon and Ambriz districts yielding the most superior quality, while shipments from Angola and Lagos show a coarser texture. It is used for knife-, stick-, and umbrella handles, carvings of all kinds: such as crucifices, statuettes . . . and covers for prayerbooks, fans etc. [9]

Beyond its genetic origins, the active nature of ivory's chemical microstructure renders this material highly responsive to sudden changes in humidity and light levels after it leaves the elephant. Once opened up and stripped of its husk or protective outer layer, discoloration and cracking readily occur if care is not taken in storage and handling.

Among ivory's many decorative and functional uses, piano keys offered the Connecticut ivoryworkers their most lucrative challenge in coping with the volatility of ivory and with the American piano industry, centered in Boston and New York. Although ivory served only as the thin veneer layer at the user end of the complex wooden key action, the largest of the ivory factories ultimately produced the full wire striking mechanism and in some cases crafted the entire piano. Ivory knowledge, however, remained the region's chief distinction.

The Piano Key

Builders of the earliest European keyboard instruments — spinettes, virginals, clavichords, and harpsichords — employed an array of tough, glossy materials to finish their keys, the all-important meeting ground of musician and machine, art and technology, thought and muscle. Nuanced interpretations of keyboard musical scores traditionally have relied on the touch of the player's fingers to transmit suitable pressure indirectly through a series of lever actions to the piano wire. Basswood and various fruitwoods were early favorites as key material, either for the broad lower keys (the naturals) or the narrow raised keys (the sharps). One or the other typically was dyed black to distinguish readily between the two key sets. Ebony wood quickly caught on as a close-grained key material for the naturals, requiring little artificial blackening.[10]

Both ebony and ivory were among the prize commodities to be won from Africa when vast territories were claimed or colonized by Europe in the 18th and 19th centuries. Ivory's greater scarcity limited it initially to the tops of the sharps. Whether due to the opening of African

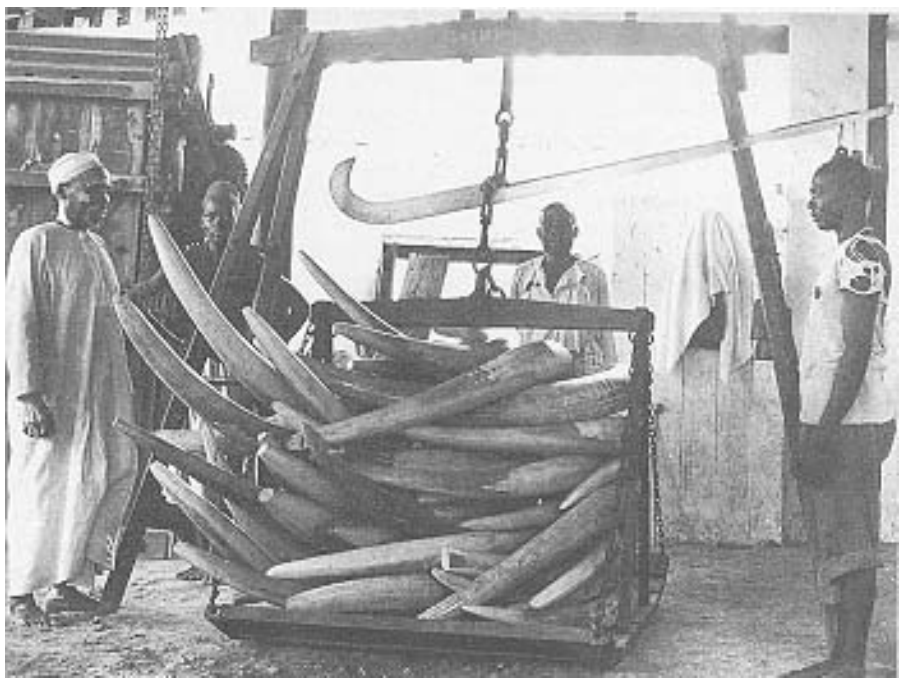

Figure 2. Tusks on a Fairbanks (Vermont) scales in Zanzibar, 1910. Ernst D. Moore Collection (321), Archives Center, National Museum of American History, Smithsonian Institute.

trade routes by Great Britain in the 18th century or a general feeling that black piano keyboards seemed ill-suited to the newly written works of Hayden, Mozart, Beethoven, and Schubert, British pianomakers emphatically shifted ivory to its present dominant place atop the naturals.[11] Mainland European makers followed, both with greater access to African trade and with ivory naturals. Supplies never were sufficient to construct keys entirely of solid ivory; thin (1/16th-inch) veneers glued to close-grained woods remained the standard, although the sharps were of solid ebony.

Among North American builders, the choice among key materials was not yet so self-evident, according to one judge at New York's Crystal Palace exhibition in 1853:

The necessity of Schools of Art and Design among us is exhibited in not a few instances, in the vulgar, tawdry decorations of American pianos, which show a great deal of taste, and that very bad. Not only do we find the very heroics of gingerbread radiating in hideous splendors, fit for the drawing room of a fashionable hotel, adorned with spit-boxes among other savageries; but even the plain artistic black-and white of the keys — that classic simplicity and harmonious distinction — is superseded for pearl and tortoise-shell and eye-grating vermilion abominations. The Committee would advise the makers of these latter instruments to keep them exclusively for the Shanghai trade.[12]

Such condemnations were not lost on the larger American manufacturers like the Steinways in New York and Jonas Chickering in Boston who already were using ivory. Connecticut ivory-bleaching patents of the 1850s cover specific treatments for speeding and enhancing the whiteness of piano keys.[13] Wrapped packs of piano key ivories were marketed by the Connecticut factories well before they expanded into the production of the entire key assembly (figure 4).

Close scrutiny of the ivory keyboard reveals two and occasionally three ivory components to every key: the short, wide head struck by the fingertip; a long, narrow tail extending back between the sharps; and among certain builders, the key's vertical front or face beneath the head's nosing. The head and tail are butted together where the sharps begin, producing a fine but unmistakable hairline across the ivory keyboard (figure 5).

Economy and breakage dictated this two-piece configuration, the 1/2-inch by 4-inch tails glued left or right above 1-inch by 2-inch heads to form the full eight-key octave. Wastage would have been considerable and excavation from the tusks very tedious if key tops were not simple two-piece rectangles but long one-piece L-shapes and T-shapes cut to fit around the sharps. In addition, the inherent brittleness of ivory would have made the right-angle cut a center of stress prone to fracture during manufacture and usage were the head and tail not separate. The two-piece arrangement also made head replacement easier if damage did occur after attachment to the keyboard.

Figure 3. Off-loading tusks at Comstock, Cheney & Co., Ivoryton, 1890. Both buildings survive intact and in use. Pratt-Read Records.

The true head-tail genesis may have had more to do with the early scarcity of quality ivory in Europe, when maximum use was made of each available chunk. This dimensional standard nonetheless remains a signature of ivory keys, distinguishing them from the seamless white materials that followed. Two important exceptions are the mammoth-ivory key (fabricated in Germany today from Siberian tusk) and the American cow-bone key (manufactured in Rhode Island from bovine femurs, principally for pipe organs). The scarcity of high-quality bone and mammoth ivory, and the costs involved in their fabrication into heads and tails, may limit wider applications.[14]

American ivory-goods manufacturers — chiefly the billiard ball makers — began calling for a replacement ivory as early as the 1870s, when the quality and quantity of elephant-tusk imports began to show signs of uncertainty. Celluloid piano keys, first appearing late in that decade, were one of the first trial applications of a faux ivory. Striated celluloid could be fashioned to simulate ivory's grain, but pianos with such keys rarely rose above the cheaper mail-order instruments at the lower end of the market. As Robert Friedel has observed in chronicling the difficult early years of this material, imitation never fully matured into substitution as long as both status and performance remained the exclusive domains of ivory.[15] Celluloid eventually found favor with some prominent pianomakers as a thin facing material for the unfingered fronts of the piano keys. But ivory's dominance on the piano clearly was not just a matter of appearance. Many concert pianists have maintained to the present day a preference for the smooth but slightly tacky, moisture-absorbing feel of ivory. In a 1931 issue of *Scientific American*, one Connecticut ivory man summed up the sensorial attraction ivory holds for piano players: "It is yielding to the touch, yet firm; cool, yet never cold or warm, whatever the temperature; smooth to the point of slipperiness, so that the fingers may glide from key to key instantly, yet presenting just enough friction for the slightest touch of the finger to catch and depress the key and to keep the hardest blow from sliding and losing its power."[16]

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The Piano Key Bleach House of Deep River, Connecticut

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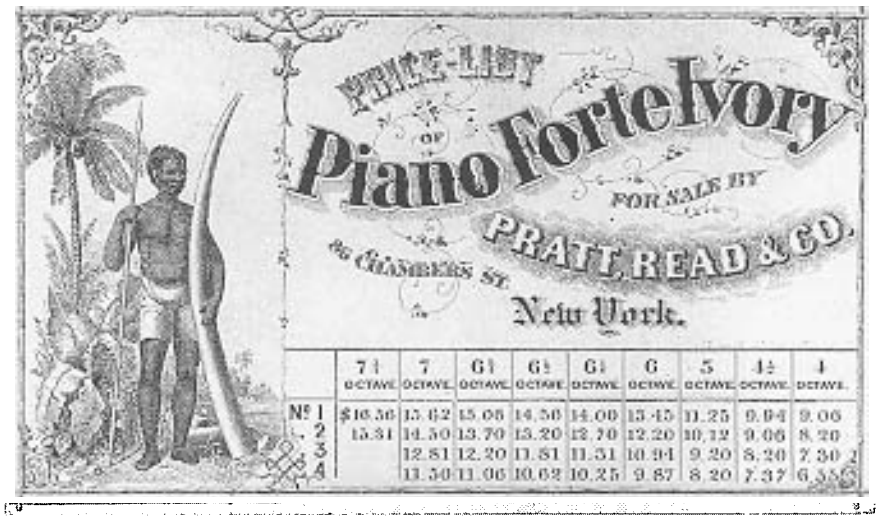
Bleaching Ivory

As a primary attribute, the ivory key's distinctive hue exists neither uniformly throughout the tusk nor is it easily standardized once the raw ivory has been worked. Gradations of white, from mottled yellows and grays to faint reddish browns can occur naturally, depending on the elephant's diet, genetic inheritance, and state of health. Ivoryworkers in industrial Connecticut sought to mitigate such variation by employing bleaching regimes more commonly associated with the bleaching of textiles and human hair.[17]

Sun-bleaching supplemented chemical solutions once it was discovered that sustained daylight and heat would both whiten ivory and accelerate the activity of the liquid bleaching agent. Deprived of light over an extended period, ivory darkens to an amber brown. The actual mechanism within the ivory that triggers such color changes is little understood, judging from the industry's near-total reliance on empirical testing.

One clue comes from a distant but not unlikely source. In recent decades, the bleaching of discolored teeth has become a dental option for fashion-conscious Americans.[18] The dentine or ivory in human teeth is protected by a hard enamel and has a less intricate microstructure than in elephants, but the chemical makeup is identical. Dental bleaching services, stain removal, and whitening techniques typically involve applications of a 35-percent hydrogen peroxide solution activated by 30 minutes beneath a high-intensity heat lamp set between 115 and 160 degrees Fahrenheit. The technique is capable of bleaching up to 10 frontal teeth in three sittings.[19]



	7⅓ OCTAVE.	7 OCTAVE.	6⅓ OCTAVE.	6½ OCTAVE.	6⅓ OCTAVE.	6 OCTAVE.	5 OCTAVE.	4½ OCTAVE.	4 OCTAVE.
№ 1	$16.56	15.62	15.06	14.56	14.06	13.45	11.25	9.94	9.06
2	15.31	14.50	13.70	13.20	12.70	12.20	10.12	9.06	8.20
3		12.81	12.20	11.81	11.31	10.94	9.20	8.20	7.30
4		13.50	11.06	10.62	10.25	9.87	8.20	7.37	6.56

Figure 4. Price list for pre-cut sets of key ivories, eight keys per octave, 1860s. Grades at left refer to the grain: the less pronounced, the better the grade and the higher the cost. Pratt-Read Records.

Post-bleaching dental studies suggest that light-sensitive molecules causing discoloration within the teeth are released through the photooxidation that occurs during bleaching, when the bonds with non-colored or "white" molecules are weakened or broken. But the living connective tissues in human teeth appear to regenerate the problem molecules and usually produce a color reversal in bleached teeth after a few weeks.

Ivory for piano keys was cut only from the interior layers of the extracted elephant tooth, an area that exhibits considerable variation not only in hue but in grain patterns. A second goal of ivory bleaching, therefore, was to minimize the visibility of grain, in turn minimizing key-to-key variation.

Unlike the growth rings in wood grain, the apparently two dimensional grain of ivory is largely an optical effect caused by the incidence of light striking varying depths of an intricate tubular canal system that grows progressively outward from the tusk's pulp chamber. The luminescence of finished ivory derives from this mineralized but seemingly liquid network of three-dimensional gelatinous fibers. In cross-section, these serpentine canals take on the interwoven appearance of machined knurlings or the "engine turnings" cut into ornamental pocketwatch cases by the tooling of European rose engine lathes[20] (figure 6).

Within the scientific community, the unique crosshatching of elephant ivory is termed the Schreger pattern, after the German researcher who first described this figuring in 1800.[21] The lines increase in definition and their weave opens up as they approach the perimeter of the tusk, suggesting that progressive structural weakness also occurs as the ivory moves outward from the center.

On the piano keyboard, unlike virtually all other ivory arts, these undeniably beautiful traits were regarded as visual distractions and liabilities, either in transverse section or longitudinally. This preference for grainlessness contrasts with the swirling mahogany, oak, and walnut veneers selected for the piano's surrounding casework. The down grading or out-

Figure 5. Ivory keyboard detail, American grand piano, 1880s. Photograph by the author, 1993.

right elimination of keys with visible grain was dependent largely on the actions of the bleach house and, at a later stage, the matching table. This importance of grain will be revisited in the description of the matching process.

The Bleach House

The ivory industry's signal contribution to architectural history certainly is the freestanding, knife-edge bleach house. Rank upon rank of these long, prismatic structures lined the hillsides around Deep River and Ivoryton. In all other respects the surviving ivoryworking factory buildings are the typical 19th-century brick two-to-four-story, open-bay, high window rectangles found across the industrial landscape.

The main Pratt-Read factory in Deep River, built in 1881, is now the Piano Works condominium complex. The unexceptional ivoryworkers' company houses that remain in rows along the side streets are owner-occupied today, many considerably modified with add-ons. But on Main Street near the Kelsey Hill Road turnoff, inside a dense stand of low trees and underbrush, is the rusted semi-windowless bleach house.

That the only survivor of this species has been taken over by vegetation is not altogether inappropriate. In the late 1920s local resident Joseph Suda purchased this 31-foot segment of what was probably a much longer structure and transported it from the Pratt-Read plant at one end of Main Street to his farm at the other end, where it served as a greenhouse into the late 1970s. Thus it rejoins in afterlife the global family of glasshouses better known for their connections to flowers, trees, and world expositions. The 18th- and 19th-century cast-iron conservatories, orangeries, arcaded winter gardens, crystal palaces, hot houses, and domed glass pavilions of Europe and North America enjoy a special jewel-like stature in the world of architecture. Their graceful webs of cast iron produced fantasy-like atmospheres of outdoor wonder in indoor comfort. None of the historians of glass architecture, however, have yet discovered the ivory bleach house, a distinct although non-public subspecies of this transparent family.[22]

Until a devastating flood swept through nearby Ivoryton in 1982, a second, larger bleach house, on its original Comstock-Cheney factory site (figure 7), survived the 1950s dissolution of the local ivory industry. The flood or its aftermath of demolition did away with this in situ example, featured in Connecticut's statewide inventory of historic industrial sites.[23] No further effort at recording or landmarking seems to have taken place.

The primary face of the surviving bleach house descends at a 45-degree angle from a height of 11 feet. Rolled steel bars bolted to angles and channels make up the framework. Fixed window sashes on the primary face held 60 panes of glass, each 18 inches wide by 50 in height. This furnished space for 120 of the sawtooth zinc head racks (two racks per pane, each holding 200 heads) or 60 tail racks (82 tails per rack).

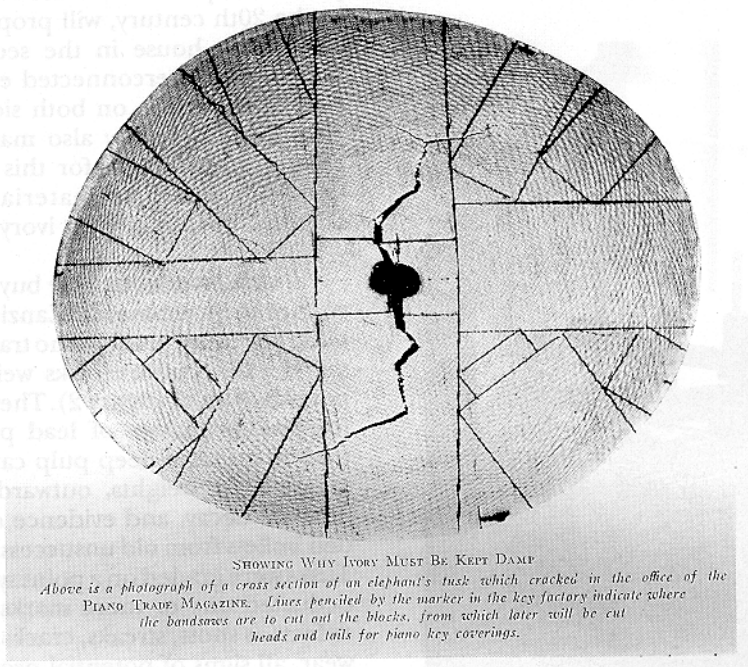
The rear glass wall slopes buttress-like 10 degrees from the vertical and, together with the glass side walls, admits indirect side light to prevent shadow lines from falling on the keys racked in the main face. The interior space, 12 by 31 feet, has lost the steam lines that would have kept the house at a uniform humidity and temperature (100°F), but the original hand-geared vent windows along the top of the back panels remain, although rusted fast. Suda appears not to have required the flooring, planting his greenery in the soil enclosed by the structure's walls.

The wall base plate, a nine-inch inverted rolled channel, is bolted beneath the front and back and along one side panel. Anchor bolts run through this channel into a shallow concrete foundation. Along the fourth side, a channel seems never to have existed, and a two-by-eight-inch timber carries the glass side wall. This, together with the rough-cut channel ends, suggests that this structure is a section amputated from the end of one of the more typical bleach houses 400 to 600 feet in length.[24]

Except for length and the lack of a floor, the Deep River bleach house incorporates the features typically found in the surviving drawings and photographs of these modest structures. Their scale and construction were suited entirely to their single-use purpose. They were free of ornamentation and just tall enough to admit a worker with hands stretched overhead to place a rack of ivory in the topmost windows.

Functionally, they were cousins of the slant-roofed glass orangeries and peacheries of 18th-century English manor houses and the 19th-century glass-walled American photographic printing studios, both types usually mated along their back length to larger buildings in place of a rear wall.[25] In rows, the bleach houses might be mistaken for sawtooth monitor roofing over some vast subterranean factory.

The Connecticut bleach houses were space frames, easily supporting their own light weight without the addition of roof trusses, columns, or beams. Those built on piers rather than foundation walls



SHOWING WHY IVORY MUST BE KEPT DAMP

Above is a photograph of a cross section of an elephant's tusk which cracked in the office of the PIANO TRADE MAGAZINE. *Lines penciled by the marker in the key factory indicate where the bandsaws are to cut out the blocks, from which later will be cut heads and tails for piano key coverings.*

Figure 6. Tusk cross-section, showing interwoven Shreger lines, overlaid by blocking layout for piano key heads and tails. All face the center to minimize non-symmetrical grain. The fracture growing outward from the pulp cavity suggests that excessive drying occurred after blocking. From "The romance of the Ivory Piano Key," Piano Trade Magazine, March 1925, p. 62

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The Piano Key Bleach House of Deep River, Connecticut

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could be shifted about to accommodate new construction or changes in the work routine. Such portability also facilitated the demolition of bleach houses when their sole-use function had ended. Needless to say, plastic keys require no bleaching from the sun. And unlike old factory buildings, low, triangular, all-glass houses make for unsatisfactory warehouses or living quarters. Judging from local commentary and post-use photography, rock-throwing target practice seems to have been their chief attraction in the twilight years before their scrapping.

Foretelling the end of the ivory key, Pratt-Read demolished the great field of bleach houses behind its Deep River factory in the 1940s to clear land for the war effort: building troop carrying wooden gliders.[26] A handful of bleach houses remained a few miles away in Ivoryton for the diminished key production that resumed after the war.

Who built these structures? The woodwork and bolted angles would not have been beyond the means of the factory shops. But one late-19th-century drawing of proposed bleach houses for Pratt-Read is stamped "Arthur E. Rendle's Horticultural and Glass Roofing Works, 44 & 46 Broadway, New York."[27] The surviving house shows no rolling mill marks on exposed metalwork, but a date around the turn of the century is likely, a period when the ivory factories were expanding their capacity to accommodate the growth in piano manufacturing.[28]

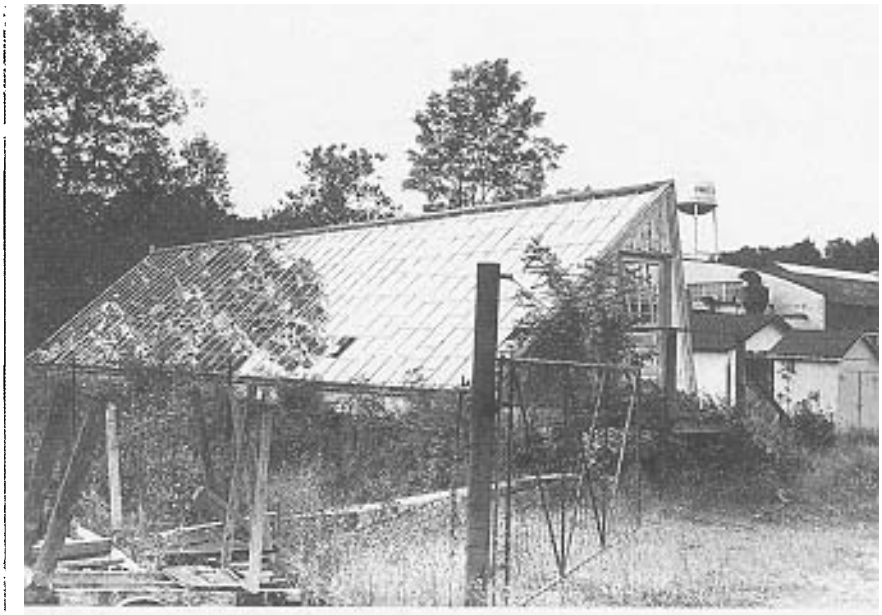

Figure 7. Ivoryton's last bleach house, 1970s, derelict but sound, later to be the victim of a 1982 flood. Pratt-Read Records.

Ownership of the last bleach house rests with Suda's granddaughter who has agreed to donate it to the Deep River Historical Society if means can be found to remove it to the society's grounds a few blocks up Main Street. Meanwhile, the bower provides a dark, protective camouflage for the structure while it once again awaits sunny days.

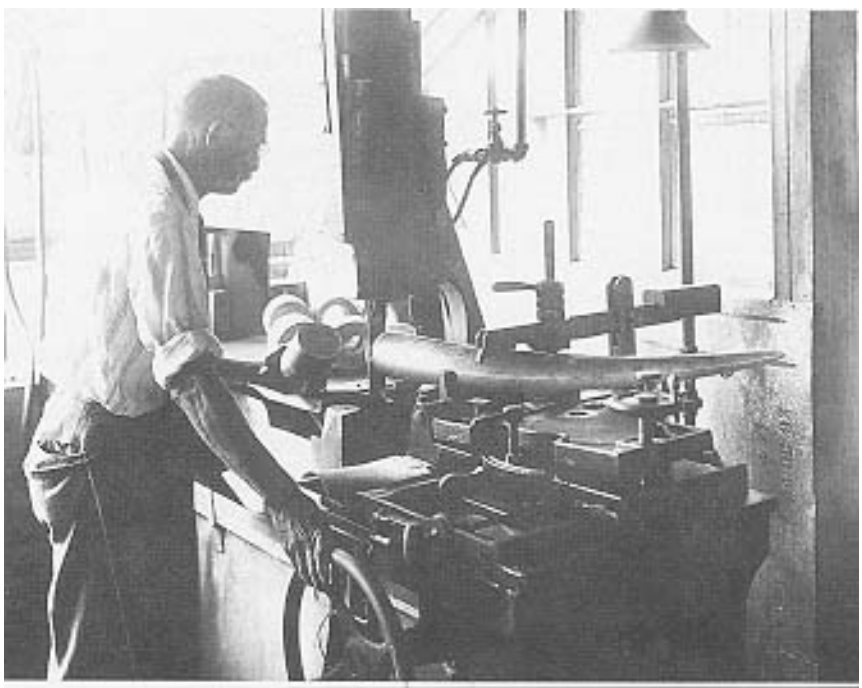

Figure 8. Junking a tusk into four-inch sections on a shop-modified, water-cooled bandsaw at Pratt-Read, 1920s. Ernst D. Moore Collection.

Key-Making

Prior to their arrival at the bleach house, the ivory key veneers underwent a series of sawings, soakings, examinations, and other manipulations. After their sun-bleaching, the inspections and physical treatments continued before their final attachment to upright and grand pianos. A review of the ivory key manufacturing process, as practiced in the region early in the 20th century, will properly place the bleach house in the sequence of distinct but interconnected events that were taking place on both sides of the glass. Such a review also may foster a greater appreciation for this relic and the high levels of material control achieved by Connecticut ivoryworkers.[29]

Tusk Selection: The buyers in Europe or in Mombasa and Zanzibar examining raw tusks for the piano trade sought the thicker, mature tusks weighing 40 pounds or more (figure 2). They checked for hidden masses of lead poured by traders into the deep pulp cavity to increase scale weights, outward signs of internal decay, and evidence of imbedded bullets from old unsuccessful hunts. Tusks were graded on a point system that deducted one or more marks for such defects as spots, streaks, cracks, rings, or wear, all signs of potential problems internally that could diminish the yield of quality keys.

Further grading and weighing would

Figure 9. A sawyer at Wood & Brooks (Buffalo) parting junked tusk sections into head and tail blocks. Semi-sawed blocks stand in the foreground. Note coolant shields over saw blade and sawyer's chest. Wood & Brooks Records Collection (457), Archives Center, National Museum of American History, Smithsonian Institute.

occur at the factories where tusks were bundled in straw and stored in the ivory vaults. If subgrade for piano keys, they might go to the comb shops or other specialty works on the premises or be resold to factories elsewhere in the region.

Junking: Heavy-framed woodworking bandsaws modified with deep, fine-toothed blades, radial indexing, and coolant jets were the first machines to contact the tusk (figure 8). Saw operators "junked" the central portion into four-inch cylindrical blocks sawed at right angles to the tusk. The actual junk — the tip and the furrowed ivory around the pulp cavity — would pass to other production lines for lesser ivory goods or join the ivory sawdust to be burned and ground to a silky powder for use as the paint pigment or decolorizing agent ivory black.[30]

Blocking: Carried to a separate bench under a damp cloth, each block's end-grain would be carefully scribed by a blocker with lines showing the optimal distribution of head and tail sections obtainable inside the ivory's tough husk-like outer layer (figure 6), quite like dimensioned lumber being marked for sectioning from a solid log. All head and tail sections stood upright and faced the center of the tusk to keep the axial grain patterns relatively uniform. Crosscut keys would have been intolerable, both structurally and historically, despite the luminous beauty of ivory's cross-grain.

Parting: In a second saw shop, workers hand-fed the blocks through water-cooled circular parting saws (figure 9) to remove husks and produce the rectangular solids from which the heads and tails would be sawed. The high-quality ivory wedges sawed from between the solids would move elsewhere to become toothpicks, ear cleaners, tool handles, or other ivory wares up to four inches in length.

Slitting: Using stops and guides, key sawyers rapidly fed their head and tail blocks longitudinally through thin, fine-toothed circular saws running in water, working in a back-and-forth "meat-slicing" motion until the blocks were reduced to 1/16th-inch heads or tails on one side and stub residue on the other. The thickness of each head and tail tapered slightly, presenting the thickest portion to the fingered region and producing a thinner, finer joint where head and tail would meet.

Perhaps unintentionally, the circular saw marks on both sides of the keys contributed at a later stage to the uniformity and speed of the bleaching process, exposing greater amounts of angular surface area to the action of the sun. The saw marks also provided a gripping surface for the hot glue during attachment to the keyboard, although toothing machines later augmented this role at Pratt-Read. After this final sawing stage, additional lines of machines profiled each key and undercut the butting edges of each tail and head to ensure a nearly invisible joint.

Chemical Bleaching: Prior to World War I, there was a near-continuous process of fine-tuning liquid bleaching regimens, judging from the diversity of additives to the basic hydrogen peroxide solution described in the surviving records. The slightest excesses in grain and color were grounds for reconsidering and adjusting the makeup of the liquids in which the key veneers soaked prior to their placement in the bleach house.

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Figure 10. Wood & Brooks shop foreman Andrew Probst pulls a fistful of heads and tails from a jar of peroxide bleach, 1920s. Note temperature recorder and shrouded bleaching cabinet. Wood & Brooks Collection.

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Keeping sets of ivories sawed from the same tusk (not necessarily from the same block) together, key workers moved the ivory slips through baths of warm water and drying chambers, ultimately loading heads and tails into glass jars filled with dilute hydrogen peroxide spiked with either potash, turpentine, sulfuric acid, kerosene, ether, or distilled water, depending on the decade, the vogue of the factory, or the appearance of the ivories. By the early 20th century, Pratt-Read and the Wood & Brooks Company in Buffalo (figure 10) had settled on a straight hydrogen peroxide bath lasting up to 72 hours. Since 1818, hydrogen peroxide was known as a powerful oxidizing agent, relaxing and liberating heavier molecular compounds within porous materials, an action accelerated by sunlight.

Pre-soak and post-soak ivory-drying schedules and bleach water temperatures were special areas of concern, given ivory's structural and visual volatility. Operator expertise and suitable facilities were vital in maintaining the level of control these procedures required, as Charles Wood, head of Wood & Brooks, confided to a colleague in 1914: "We have had difficulties for many years with yellow ivory, on account of the fact that we lacked the space to dry the ivory out thoroughly before it was put into the bleach water, with the result that when it was rushed through the least bit on this process we would be up against it later on."[31]

Workers dumped the saturated ivory into large, screened trays for days of drying as the heads and tails adapted to conditions in the humid, daylit bleach house (figure 11), a period during which the heat inside the glasshouse would further activate the residual bleaching chemicals within the ivory.

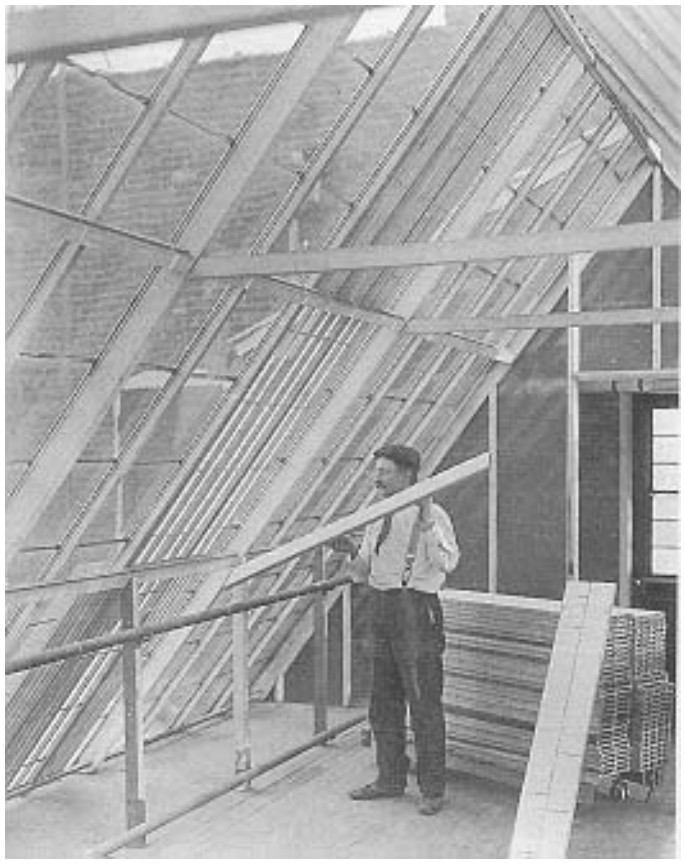

Figure 12. A rack of tails being "put to glass" at Wood & Brooks's unusually spacious bleach house on the roof of its main factory, 1920s. Note cartful of loaded racks. Wood & Brooks Collection.

Sun-Bleaching: By the 1840s worked ivory systematically was being exposed to the action of the sun's rays in Connecticut while confined behind glass, judging from Ulysses Pratt's bleaching patent of 1852 that briefly reviews existing techniques: "bleaching thin pieces of ivory, for veneering piano keys and other purposes by placing the ivory upon trays, boards and other flat supports . . . and covering the same with glass in frames placed at various angles, and sometimes suspending the ivory by strings and loops or otherwise, in front of a common glass window."[32]

Figure 11. Inside a Wood & Brooks bleach house, heads and tails drying in trays below the glass prior to racking, 1920s. Wood & Brooks Collection.

Sun-bleaching continued largely unchanged from this basic approach until ivory's outright displacement in the 1950s. Neither artificial light nor chemical bleaches ever surpassed the effectiveness of sunlight, despite the sun's seasonal randomness and unregulated intensity.

Why the glass? Why not lay the ivory in open-air racks. Beyond protection from the elements, the glass served as a shield to block the sun's ultraviolet lightwaves. These high energy rays can break down vital chemical bonds within the ivory that maintain its whiteness and structure, and the ivory could burn and peel beneath the unmodulated action of the sun. Such effects had been known theoretically since the 17th century, but Connecticut's first ivory bleachers could have discovered this on their own through trial and error. Finally, the glass furnished an environment in which captive heat and humidity could facilitate the bleaching process, as the sun's infrared and visible lightwaves passed through to act on the pigmented ivory.

While maintaining the tusk integrity of each key set, bleach

house workers loaded heads and tails from the drying trays into non-corrosive, zinc-fitted wood racks, inclining each ivory in a stepped fashion similar to the outdoor seating arrangements known today as bleachers. The racks fitted into guides or were pegged into the window frames an inch or so below the glass (figures 12, 13). Sun time varied from weeks to a month or more, depending on available light, the season, and the appearance of the ivory. Every head and tail was turned during the bleaching to thoroughly whiten each edge and the interior (thin ivory tends to be translucent). A completed bleach would be gauged visually and/or with a weight test to determine total moisture loss.

More than one inventor attempted to accelerate the sun bleach by locking the ivory into reversible glass racks, placing reflective materials below the keys, or turning the keys on end (U.S. Patents 15,590, 15,983, and 13,928). But no such approach succeeded in displacing the laborious hand flipping of each head and tail and the watchfulness necessary to avoid the cracking or warping of keys due to excessive moisture loss.

Matching: Scrutiny of the individual keys intensified with the stacking and movement of the sets to the factory matching tables, after the keys once again had been dumped into trays and allowed to cool and dry further, out of the direct rays of the sun.

Pratt-Read and Wood & Brooks (figure 14) employed women to create the matched keyboard, judging from existing photographs and retired workers' testimony (figure 15). Theirs was essentially a reconstructive task, selecting heads and tails sawed from the same strata or depth of the common tusk, enabling a given key set to exhibit the same fineness or coarseness of grain from one end of the keyboard to the other. The matchers essentially sought to create within a single horizontal plane what had existed vertically and in circular form within the tusk.

In a pioneering body of work, Anthony Cutler has isolated the ways in which the unpredictable directions of elephant ivory's longitudinal grain were exploited by Byzantine ivorycarvers in the third to tenth centuries A.D.[33] The grain takes unexpected twists and loops as it undulates in three dimensions through the tusk. These hidden features added definition and realism to sculptural forms if the grain was properly managed by the carver. In Connecticut, too, grain management was a concern, but for the opposite reason.

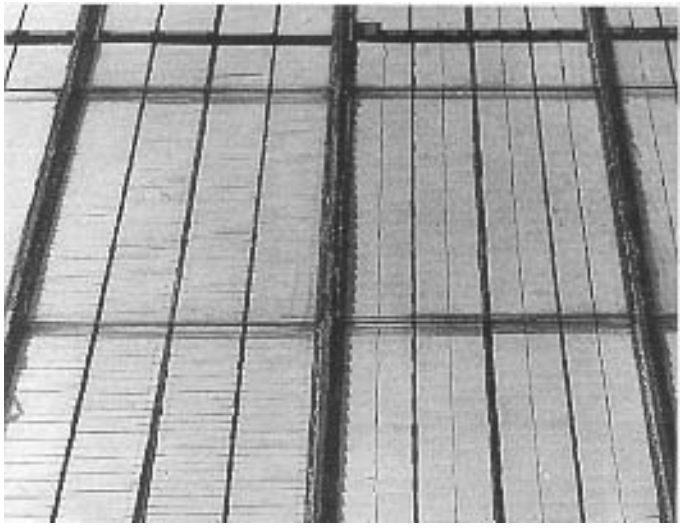

Figure 13. Bleach house outside window detail, inclined tails and heads resting on zinc-toothed racks, 1930s. Pratt-Read Records.

Figure 14. Aerial view of the Wood & Brooks factory, buffalo, 1930s. Bleach house on the roof of the main building appears in figure 12. Other bleach houses sit Connecticut-style on the ground (right). All buildings except bleach houses remain standing today. Wood & Brooks Collection.

The best grades of keys were matched from center-cut ivory that displayed the least figure. (See figure 16) But the more plentiful and variegated keys from the outer half of the tusk's diameter struck one piano trade publication in 1925 as actually more desirable, momentarily placing in question the linkage of grainlessness with quality: "The highly figured ivory is prefered by makers of fine toilet articles and by piano makers in Europe. It was found by them to have better wearing qualities.... The piano makers of the United States, if they choose, with the cooperation of the key makers, can make the figure in an ivory key an asset and not a liability. The result will probably be a slight increase in the price of the figured ivory.... Is it not foolish for the piano salesman to point to plain ivory on the keys of his instrument as evidence that the piano is of superior quality?"[34] American keymakers, probably aware that the center-cut ivory was younger and less subject to dryness, cracking, and yellowing, did not share this thinking, retaining their anti-figure preferences to the last days of the ivory key and into the completely grainless white plastics that followed.

Scrutinizing their stacks of ivories for telltale grain patterns, the matchers sat opposite large windows with northern exposure. Natural light was supplemented in later years with ultraviolet lighting hung directly over the tables to reveal more fully subtle grain variations. Completed key sets would be struck with a sloping pencil line that enabled the sequence to be swiftly re-established on the actual keyboard.

Laying: Head and tail sets were reunited in the laying department on sugarpine or basswood keyboards, the keys butted head-to-tail, and across the board head-to-head with no spacing between. A six-inch strip of linen served as a separation and expansion layer between beds of hot glue applied to board and ivories. Once laid, covered with oiled paper, pressed, and set, the keys would undergo one more ivory-surfacing procedure.

Grailing: Removing pencil marks, glue, burrs, paper, and other imperfections, hand-guided grailing machines passed saucer-like surface-milling cutters across the full ivory keyboard, producing a uniform surface and precise key height. Felt buffing wheels polished the keys, removing the grail's

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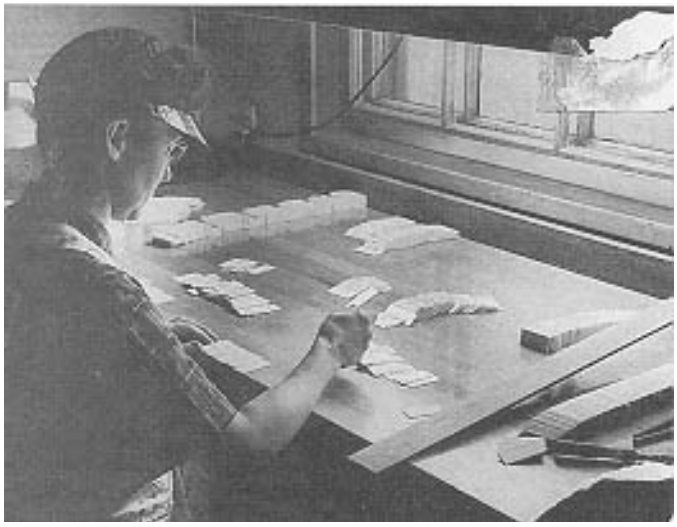

Figure 15. Evelyn Berry matching key heads at Wood & Brooks, 1930s, assisted by northern daylight, ultraviolet tube, and eyeshade. Wood & Brooks Collection.

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circular tool marks and giving the keys a soft, reflective finish before their final segmentation into separate ivory wood keys.

Keyboard Sawing: The wood panel below the ivories adopted the profiles of the individual heads when the full board was hand-fed into five-bladed circular gang saws to part the three-ply ivory-linen-wood sandwich (figure 17). This pass produced the final head and key width. Other band and circular saws completed the segmenting of keys from the rear of the board and prepared slots for the addition of the ebony sharps, fabricated in an adjacent shop. Following the corner-beveling of each head, the journey ended with attachment to action assemblies and insertion into the piano case.

All of the ivory's wetting, drying, heating, and cooling represents a remarkable odyssey, given ivory's storied readiness to crack and twist when exposed to sudden shifts in moisture content and ambient temperature. The hot glues, the immersions in bleaching solutions, the passage through water-cooled saws, the action of the sun, and the other invasive treatments added up to a punishing regimen for any natural material, certainly one as reactionary as ivory.

Yet the open defiance of this reputation for delicacy suggests the facility with which the keymakers understood ivory's real limitations and abilities, mocking those imposed by non-ivoryworkers through latter-day examinations of long finished ivory goods.[35]

Preservation

After World War II a pair of trends led to the current circumstance of a solitary rusted bleach house sitting nearly glassless in a tangle of Deep River vegetation. Neither trend alone would have had quite the success that the two did in concert.

By 1949 managers at Pratt-Read were expressing frustration over the lack of young ivoryworkers on hand to renew the skills required to meet a swelling postwar demand for pianos: "A skilled worker is needed; one who can lay both ivory and celluloid, sand, scrape and polish, and yet there seems to be no one to draw on. At present time we have only two regular ivory layers with no younger person breaking in. The average age of our ivory workers from the saw room, bleaching, matching, laying, and processing, probably is over sixty. Let us do something about this situation before our skills are lost completely. There is something wrong with our system."[36]

Within a few years, industrial chemists transformed this warning into prophecy. Plastic was looked on by Pratt-Read executives not only as a cheaper key material more accessible than ivory. Peter Comstock, company president, stated the reasoning in his 1956 annual report: "New types of plastic key covers . . . will gradually simplify our production problems as the processing of ivory key veneers from elephant tusks is a difficult, expensive and time-consuming task."[37]

Synthetic injection-molded naturals and sharps eliminated the host of hand trades that vested exclusive production knowledge in the increasingly frail hands of the ivory and ebony workers. Pratt-Read's commitment to the new laboratory-based technology was reinforced in 1961 by its acquisition of Tech-Art Plastics Company of Morristown, New Jersey, specializing in plastic piano components.[38] Television's inroads into the American piano market also pressed the industry to cut costs and diversify output. In 25 years, Pratt-Read, having become a fabricator of plastic and wood components for manufacturers of furniture and hardware, would be out of the piano business altogether.

By 1958 ivory no longer was cut into piano keys in Connecticut. Buffalo's Wood & Brooks closed its doors in 1970. Any new American-built pianos subsequently fitted with ivory carried foreign veneer sets or full keyboards from abroad. But this too was a time-bound adjustment, dependent on the continued availability of the raw material.

At the other end of the equation, elephant herds in Africa had been disappearing from coastal regions since the late 19th century. The smaller Asian species was also in retreat in India and Southeast Asia. By World War I, billiard balls had joined with piano keys, knife handles, and finally tourist carvings mass-produced in Asia to place formidable pressure on ivory suppliers, and in turn on elephants.

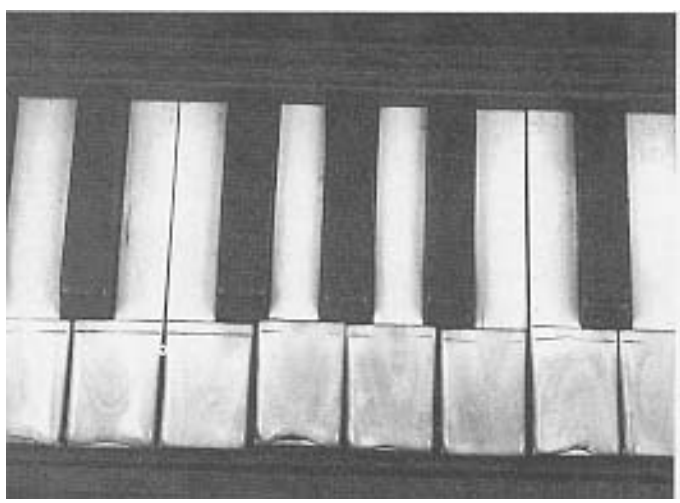

Figure 16. Highly figured heads age-darkened and worn with usage on a 17th-century Italian harpsichord. The visible V-grain patterns (pointing toward the tip of the tusk) show these keys to have come from the prime ivory around the tusk's central axis. Imperfect matching reversed the direction of some keys. Photo by Doc Dougherty, 1993; Division of Musical History, National Museum of American History, Smithsonian Institute.

Competitive demands for massive amounts of the raw material did not encourage the protection or even intelligent management of the all-important but exceedingly remote source — mature elephants with large tusks. The optimal solution — salvaging fully grown tusks only from old elephants that had died of natural causes — apparently was not a realistic market option. Virtually unregulated hunting continued until surveys in the 1970s revealed astounding reductions in elephant populations across Africa and Asia.[39] Unlike the Asian species, African elephants also have been threatened with extinction by their reluctance to breed in captivity.

Subsequent U.S. government restrictions and in 1989 the domestic ivory import-export ban (the African Elephant Conservation Act) rendered the ivory piano key politically obsolete, but it had become industrially obsolete three decades earlier. Abroad, the United Nations Convention on International Trade in Endangered Species has placed severe restrictions on the movement of raw or worked ivory from nations with herds of wild elephants and walrus to the ivory importing nations, chiefly in Europe, North America, and Asia.[40]

Another equally global dilemma has focused on the concert pianist's unsentimental regard for the ivory key. Musicians who perspire heavily have discovered an embarrassing tendency for their fingers to hydroplane across the slick surfaces of mirror-finish plastic keys, a problem once resolved by insisting that concert grand pianos be fitted with ivory.[41] Pratt-Read and many other firms have introduced various celluloids and acrylics under names such as Ivorine, Ivoplast, and Ivorite to replicate ivory's whiteness. But the peculiar grip of the ivory keyboard, a concern primarily of professional players, has been more elusive, despite trial uses of cow bone, mammoth and fossil-walrus ivory, and textured plastic. A product developed in 1992 by a tribologist (friction engineer) at Rensselaer Polytechnic Institute in Troy, New York, with support from Steinway & Sons, may open a new chapter in this quest.

The new substance, trade-named RPIvory, replicates the look, the feel, and — according to a number of pianists — the performance of the elephant ivory key.[42] Investigations with a scanning electron microscope at RPI revealed ivory's very irregular and porous microsurface. Even highly finished ivory was discovered to have a rough terrain of random, non-parallel ridges and valleys, pockmarked with a myriad of pores. RPIvory is cast from powdered polymers using an assortment of ivory keys as patterns that reproduce this essential surface randomness and porosity. Such methods, a direct consequence of ivory's new outlawed status, at last may satisfy one of the most dedicated groups of ivory users — the pianists — while leaving to an earlier era the costly methods of ivory's acquisition and meticulous processing.

Conclusion

As the citizens of Deep River debate the worth of preserving the bleach house on the grounds behind their stone-walled museum, let them remember not just the elephants and the pianos, but the matchers, grailers, junkers, blockers, and sawyers — almost all gone now — who displayed levels of skill and craft mastery that are exceedingly worthy of commemoration today. Beyond these reasons is the simple fact that this piano key bleach house is the only one left. Elephants are not alone in their stand against extinction.

Editor's Note: Since this article first appeared in 1993, the last remaining bleach house has been taken down and is being stored and prepared for reassembly on the grounds of the Deep River Historical Society.

Acknowledgments

For their help with this study, considerable thanks go to Edith DeForest, Al Gielow, Edith Sibley, Frank Stopa, George Schmelzer, Craig Orr, and the late Reginald Comstock.

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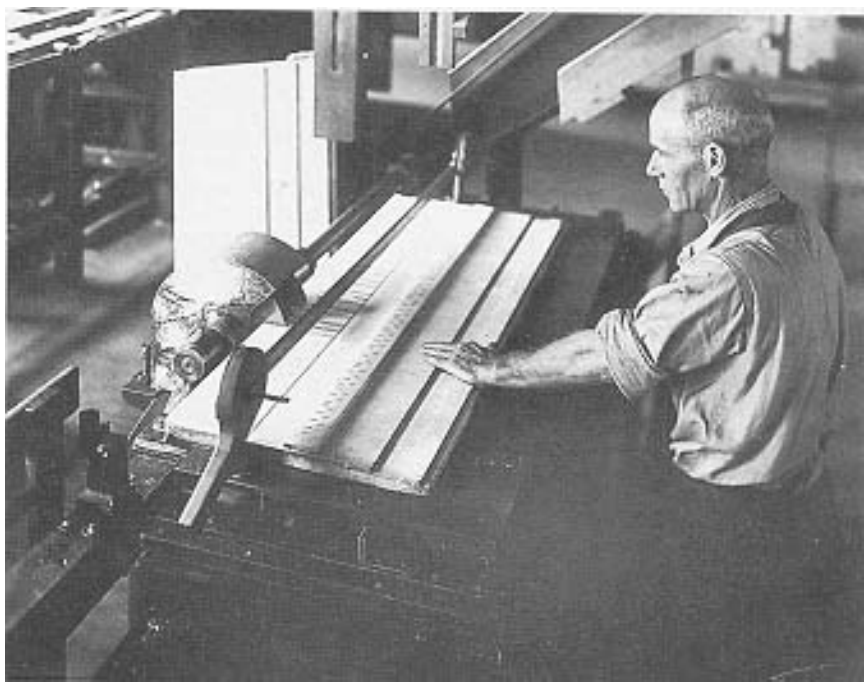

Figure 17. Parting the heads of a grailed keyboard with a five-bladed circular saw at Pratt-Read, 1920s. Ernst D. Moore Collection.

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Practical Repairs for Chipped Ivories

Steve Brady, RPT
Journal Editor

My own interest in the concept of "filling" chipped ivories began in the early 1980s as I sat thinking profound thoughts in a nitrous oxide stupor during one of my visits to the dentist. As the dentist was doing some work on my front teeth, he used a little blue light to cure the filling material in just a matter of seconds. Just as quickly, my "enhanced" mind made the connection: teeth ... repair ... durable ... fast ... ivory! Thus began an odyssey that has taken me to consultations with three different dentists, a road that has taken many odd turns, and which I've sometimes neglected for years at a time. At this point, I feel that we know enough to do solid, practical repairs on chipped ivory keytops, and to have the repairs not be too noticeable. I feel that the end of the journey is still "out there." The present article should provide some techniques that, with practice, can work for anyone. In addition, what is presented here should be "food for thought," to encourage further experimentation and dialogue on this important subject.

Some Underlying Concepts

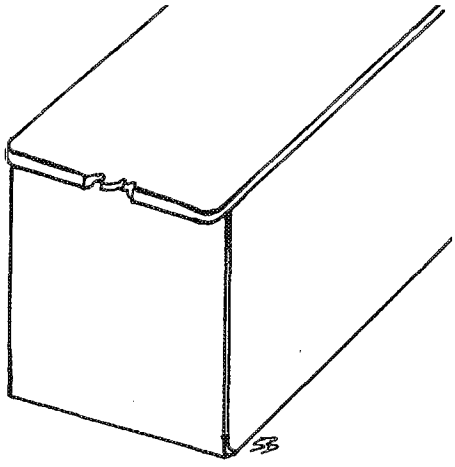
A common feature of all these methods is that they give good results only if the surfaces to be repaired are meticulously clean. Clean bonding surfaces make the filling material adhere better, and make the repair less visible. Initial cleaning can be done in a number of ways, including sandpaper folded small to get into small crevices and under the overhang, using cleaning fluids like Energine, or with X-acto knives, razor blades, etc.

A critical step in the preparation of a chip for filling is called "beveling the edges." This was first explained to me by Dr. Myron Warnick of the University of Washington Dental School. The advantages of this procedure are twofold:

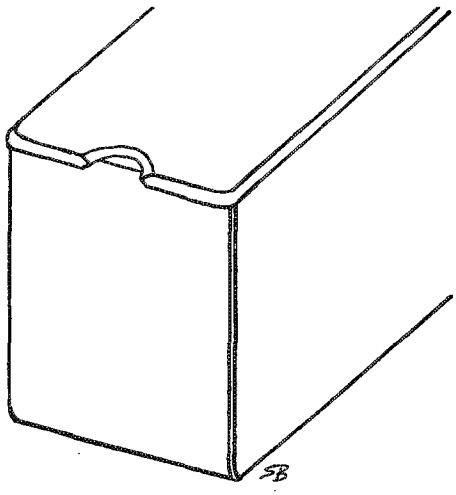
1). The final bond will be much stronger than if no bevel is created, since the bevel increases the surface area for the bond, and,

2). The final repair will be less noticeable because, instead of a sharp, distinct black line at the joint between filling and ivory (caused by a vertical bond line), the bond line will run diagonally, producing a gradual, feathered effect.

Beveling is done by using either a small round file such as the 4" Nicholson bastard-cut round file many of us have in our kits already, or with a tapered stone or carbide cutter mounted in a Foredom tool handpiece. A chipped ivory is shown in Figure 1. The completed bevel should look something like Figure 2.



A chipped ivory, Figure 1, above, and an example of how the completed bevel should appear, Figure 2, below.



In all cases, the cured filling is ground down and polished by successive applications of sandpaper or abrasive cloth. Rotary equipment such as a Foredom tool may be used, but I find that excellent results can be had by using our customary sandfiles and folded sandpaper. The important thing is to grind the gross material away with coarse abrasives (say, 80-grit or so) and to work "up the grits" until your final pass uses an extremely fine grit (at least 320). If rotary equipment is used for any phase of the work, it *must* have a variable speed controller. An uncontrolled Moto-Tool is a recipe for quick disaster .

The Epoxy Fill

My initial experiments were done using epoxy. I used white Hysol for my very first fillings. It worked fine, except for three things: the distinct black line marking the joint, the need to reinforce the repair by leaving a glob of epoxy under the overhang, and the fact that the epoxy would turn quite yellow with age and exposure to skin oils and perspiration. The first two problems went away after I learned about beveling the edges of the chip before filling. The line was gone, and the bond was usually strong enough without any sub-overhang appurtenances.

Feeling that real dental materials and light-cure equipment were too costly and difficult to obtain, I decided to adapt the beveling technique to epoxy materials. I first changed from white Hysol to Devcon "Two-Ton" clear epoxy. To the clear epoxy, I add a thickening agent, flumed silica, known by the trade name "Cabosil." This is available from boat-builders' supply companies, and a lifetime supply (for our purposes) can be bought for less than $10. The thickener gives the clear epoxy body, opacity, and an off-white color. You simply stir the thickener into the mixed epoxy until the thickness is about like peanut butter. To whiten the mixture a little more, I add a very small amount of white, powdered aniline stain, readily available from suppliers of finish touch-up kits and materials. The advantage of this "mix-it-yourself" system is that it enables a much better color match than with pre-mixed white epoxies; I've been able to produce fillings that are virtually invisible to the eye, at least when the repair is first done. Unfortunately, I know of no epoxy which does not discolor to some extent with use.

The epoxy mixture can be tinted

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Practical Repairs for Chipped Ivories

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with other aniline colors as well, but this is usually a waste of time. Not only does the epoxy darken with use, but yellowed ivories often become whiter as they are sanded. If anything, you probably want the filling to start out a little whiter than the ivory.

After the chip is prepared by cleaning and beveling, I place a piece of masking tape on the keyfront, and run it up under the overhang with my thumbnail, as shown in Figure 3. This serves as a form or matrix to hold the filling

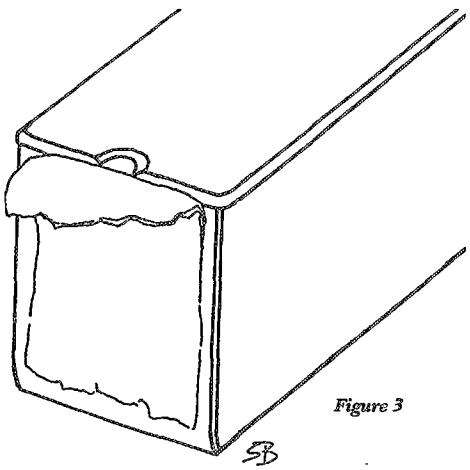


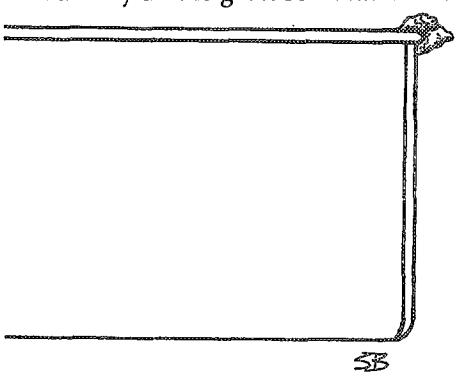
Figure 3

material until it cures.

The important thing when applying the filling material is to use plenty. You want a lot more material than "just enough" to fill the chip (see Figures 4 and 5). This insures that you really will have a complete filling when you're done. It's easy to remove the excess, but a nuisance to have to redo a filling with a gap. I like to use long-setting epoxy because it sets harder and more reliably than five-minute varieties. Whether I'm doing these in the shop or in the home, I let them cure overnight.

I usually do the gross removal with a disk sander, switching to a sandfile for the last 1/32" or so. With the sandfile, I take my strokes into the key rather than towards the front. The bond is usually plenty strong, but there's no need to tempt the fates. I use the sandfile until the filling surface is fairly flush to the keytop. I also draw the sandfile lightly across the front of the overhang to make sure it's square and clean, and that the filling is flush.

At this point, I finish the filling off with a little 320-grit folded over itself. The folded sandpaper is more flexible than a sandfile, and is able to conform to slightly hollowed ivory keytops better. If the ivory you just filled has become whiter than its neighbors due to the sanding, you should sand all of the ivories lightly to achieve a more consistent look across the keyboard. You don't want to buff the dental material; the heat will ruin it.



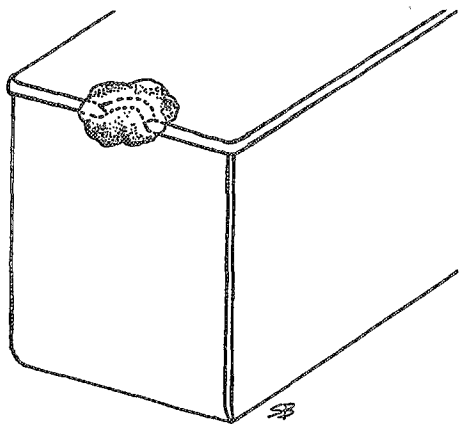


Figure 4, above, Figure 5, right.

The Cyanoacrylate Fill

This method of repairing chips with super glue and white powder was introduced in the October 1994 issue of the *Journal* by Richard Anderson, RPT. Although I personally haven't had much success with this method (probably due to lack of experience), it is certainly worth experimenting with. The method as laid out by Richard could probably be improved upon by using the bevel technique described above. In a nutshell, this is the procedure: a pile of white talcum powder is placed over the chipped area, supported by a masking tape dam (see Figure 6). A drop of thin or medium CA glue is then added to the pile and allowed to permeate the powder and cure hard. The filling is then finished in much the same way as described above. For the complete

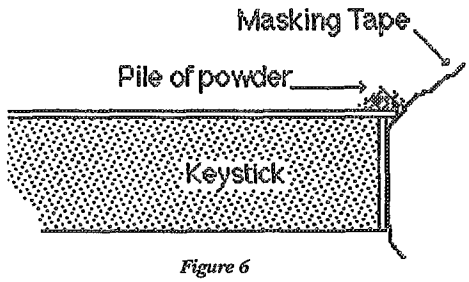


Figure 6

method, see Richard's article.

The Acrylic Polymer Fill

Richard Wagner, RPT, of the Portland, Ore., Chapter, doesn't write operas but does know a lot about ivory restorations. Besides the bleaching method he describes elsewhere in this issue, he has also developed a system for filling chipped ivories with an acrylic material. After many months of painstaking research and development, he put together a little kit with all the necessary materials and tools, as well as complete instructions for their use (see Figure 7). In my opinion, the kit is an excellent value at $39.95. The included filling material and tints allow for excellent color match, and the cured

Figure 7

material is quite hard and seemingly more color-fast than epoxy.

The Dental Light-Cure Fill

Getting back to my story, I consulted several times with my own dentist, Dr. M.J. Nixon Jr., who provided valuable insights into the different varieties of dental materials and their properties. Finally, I connected with a dentist/pianist, Dr. Douglas Leen of Seattle, who supplied me with a used

light-cure unit. For a half-day of tuning, voicing and regulating on his Kawai grand, he traded me the light-cure machine plus a hefty supply of the light-cure methacrylate resin and other materials used in the filling process (see Figure 8). He gave me a quick tutorial on the use of these components, and I was ready to start experimenting on keys.

Figure 8

The components of the light-cure system are:

- Acid etching gel
- Dentin primer
- Clear liquid adhesive
- Filling resin (with extruder)
- Light-cure machine

The chipped area is prepared by cleaning and beveling, as described above. The next step would be to etch the surface of the bevel with the acid gel. The acid etch is intended to prepare the enamel of the tooth for bonding. The gel is applied for 60 seconds, then rinsed with a water spray for 15 seconds, after which the surface is air-dried. I used a Water-Pik for the rinse and a blow dryer for the air-dry. When I prepared fills with the acid etch, I achieved strong bonds that passed my "torture test," namely, applying a bending force across the grain of the keytop (these experiments were done on spare ivory heads not attached to keys) until either the bond failed or the ivory split. The bonds were strong enough that the ivory and the filling would both split, but the bond would remain intact.

However, since ivory is really more similar to the dentin of the human tooth than to the enamel, I decided to try the process without the acid etch. I skipped the etch and, proceeding directly to the next step, applied the dentin primer (see Figure 9) for 30 seconds, and air-dried the surface for 10 seconds (no rinse is required for the dentin primer). When the filling was completed, I tried the torture test and got the same results as before; the bond held beautifully. I no longer use the acid etch in my work with ivories.

Figure 9

The next step in the dental method is to apply a thin layer of adhesive to the primed area. The adhesive consists of the same material as the filling substance, except that the adhesive is a clear liquid because it hasn't been "filled" with solids as the filling material has. The reasoning is that the liquid adhesive will be able to penetrate the microscopic caverns created by etching and priming the surface, producing a better bond than you could get with filling material alone. The adhesive is then cured for 10 seconds with the pure blue light of the light-cure unit.

The filling resin is then applied over the adhesive (see Figure 10), formed to fit the area being filled, and light-cured for 10- to 20 seconds (see Figure 11). A masking tape dam may be used for this step, but is not really necessary with the dental resins, which are very thick and putty-like. After light-curing the material is hard, ready to grind down and finish. It's okay to buff the dental material for that final finish.

My experience with the dental light-cure system is that it produces very strong bonds and durable stable fills. The equipment is easily transportable (I keep mine in a dedicated tool box) and allows a high quality repair to be done in about 10 minutes.

There are two drawbacks to the dental system: the cost of the supplies and equipment, and (surprisingly) the difficulty of getting a perfect color match. A new light-cure unit will cost in the neighborhood of $500. A used machine can usually be bought for about $100. Your dentist probably knows of a used machine for sale. The other supplies needed may cost another $100 or so, depending on where and how you arrange to buy them. I highly recommend searching your clientele for dentists and approaching one of them about it, because dentists, like us, tend to be "techies," who love to talk shop, and can be very helpful if asked. You may be able to arrange a trade, but I believe the IRS frowns on bartering. Come to think of it, I was just kidding when I said I traded work for dental supplies.

Regarding the color match, I should say that I've been unable to find an effective method of getting the filling opaque enough to become completely indistinguishable from the ivory. Dental fillings, because they are usually applied *on* a tooth rather than hanging over the edge of one, are somewhat translucent because it actually aids in matching the filling to the tooth. In other words, the color of the tooth sort of shows through the filling. Also, teeth are quite translucent themselves. With our keytop repair hanging out over thin air, it can be difficult to block the passage of light through the material, and the repair tends to look slightly darker than the ivory. I don't want to make too much of this shortcoming, because I know there is a dental system out there which would provide a perfect color match; I just haven't found it yet. Also, I believe the long-term color stability of the

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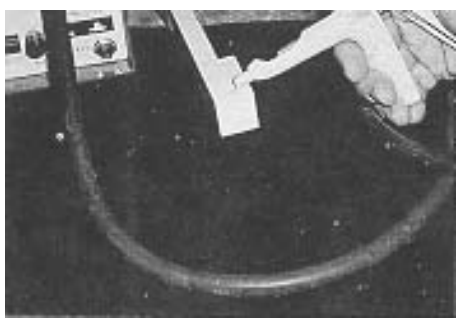

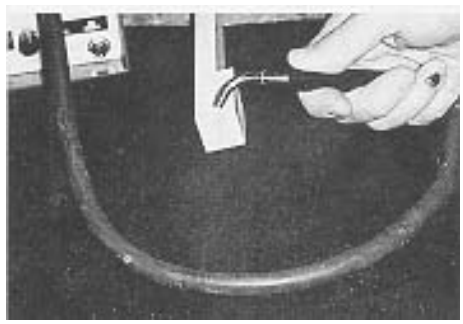

Figure 10, left, and Figure 11, right.

Practical Repairs for Chipped Ivories

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dental materials may actually be superior to other materials.

The system I've been using is Dentsply Caulk's Prisma Universal Bond 3. There are other systems made by 3M and other companies; I believe they are all similar in the way they are used. Dr. Nixon has suggested to me that the earlier light-cure materials were more opaque than the newer ones, and has supplied me with an assortment of these older "composite" materials to use in experiments. The search goes on ...

	Epoxy	Wagner Acrylic	CA Glue	Dental Light-Cure
Speed (Complete repair)	2 hrs.	20-25 min.	10 min.	10 min.
Initial color match	Excellent	Excellent	Very Good	Good
Long-term color stability	Fair	Very Good	Good	Excellent
Durability	Very Good	Very Good	Good	Excellent
Cost (Initial Setup)	$10-20	$40	$5-10	$200

In Conclusion

In the comparison which follows, I've rated the different methods subjectively in those areas where I couldn't use an objective value like time or money. All values given are approximate. These opinions are mine alone, and I must reiterate that I don't have a lot of experience with either the Wagner acrylic or the CA glue methods.

I'm convinced that the ability to repair chipped ivories is a valuable thing to have. Although there are some drawbacks to the methods presented in this article, all of them work well enough that most customers are happy to have the repaired ivories rather than new plastic keytops. None of the methods are foolproof; like any skill in our business, you need to practice a bit to acquire the right "touch," but if you put the effort into developing the skill, it will more than pay for itself.

Ivory Keyboard Restoration

By William Smith
Seattle Chapter

When you first approach a piano keyboard and scan it from one end to the other, your immediate reaction might be to classify the keyboard as good, possibly acceptable or completely unacceptable. It could be ivory, plastic or a combination of both. You must decide whether to repair the damage, to replace affected ivories with used ivories, or to replace all the white keytops with plastic or bone. In making this decision, you must factor in the customer's wants and needs (and willingness to pay the bill). This article focuses on some methods of repairing damage and doing spot replacement of damaged ivories.

Repair Existing Keyboard

If the keyboard is ivory and is relatively white with few nicks and chips, it is possible to restore it within reason. The first thing to do is to examine the keys closely for loose top fronts. Sometimes you find the ivory is loose only half way back to the joint. If so, insert glue underneath the ivory to the solid part and then clamp. (I'll get into glues later). Use a thin steel (.010" or less) spatula for inserting the glue. Let the glued ivories set at least 24 hours before proceeding with sanding or buffing.

Before this operation, however, all ivories should be examined for wear (thinness), color, nicks, chips or other damage. If the nicks or chips are not all the way back to the vertical front, and the overhang is around .070", sometimes you can sand the front tops halfway back to the vertical front. In other words, make the overhang approximately .035" — not less than this because you won't be able to make a reasonably normal corner without rounding off the vertical front top corners.

Before starting this, check with a straight edge to make sure the vertical fronts are in a straight line. You may have to relocate some of the white keys by bending the balance rail pin either fore or aft. To obtain evenness always sand the fronts with keys on the key frame.

Before any sanding is done, several ivory pieces may have to be replaced. Do that first. If none have to be replaced then the front edges can be sanded to remove the chipped fronts.

Use a 1" x 2" x 10" wood block for sanding fronts. Use a coarse grit of 50 or 60 when sanding fronts. Keep checking overhang as you sand with a straight-edge to make sure you are making a straight sanding line. Now the corners may be filed. Ivory corners are a little more difficult because ivory is a very hard material, and any sharp edges can be unpleasant to the pianist.

If the tops are to be sanded and then buffed, now is the time to do it. A good thing to remember is **sand more** and **buff less.**

In sanding the tops — a felt block 1" x 2" works well (use a thick felt from hammer trimmings) — start out with 150-grit, then 220, then 400, going on to 600-grit will mean less buffing.

This will be a good time to talk about the buffing process. A 1,725 rpm motor with an 8" buffer works well. A 3,650 rpm motor with a 6" buffer is next best. The 1,725 rpm speed works well because not as much heat is created. The white buffing compound sold by the supply houses is okay. Load the buffer heavily with the stick — the compound is doing the work, not the cloth wheel. Be careful when buffing key tops — do not dwell on the corner at the notch or fronts. Whenever the key is in contact with the buffing wheel, it should always be moving — not buffing too long in any one spot, avoiding creating too much heat as it can burn the ivory and loosen the adhesive. Try to buff away from the corners and not into the corners. Careful buffing creates a beautiful glass-like glaze with no grain ridges. You can finish off with buffing the vertical fronts if you decide to do so.

If the vertical fronts are dirty and stained, use 3/0 or 4/0 steel wool on them while they are on the key frame. Then buff.

It is essential for the keys to be on the key frame when sanding the top fronts at the overhang.

Replacing Ivory

Now, if it's been decided to replace a few ivories, look through your selection and try to find replacement pieces that come close to color and grain pattern. The length of the ivory is very important, especially if the keyboard is from one of the better quality pianos.

You will find that these pianos will have 1 7/8" or longer fronts. It is usually better to match key for key, in other words, use an ivory that came off a "c" key as replacement for a "c" key on the keyboard — or use a similar key such as "f." If you find an ivory that is too long, it can always be filed to correct length after it has been cemented or glued in place.

The ivory found for replacement might not fit well at the joint so it will have to be filed a bit to make a good, clean joint. This is not easy and should be approached with caution. A fine mill file about 8 to 10 inches in length works well. Keeping the joint line square is the tricky part. Go easy and remove as little material as possible. File one side then reverse and file the same spot slightly. The block for filing ivories as suggested by Bill Spurlock is good and will help make a good square and straight joint.

[Editor's Note: For complete instructions on how to make this tool, see Spurlock's article in the November 1991 *PTJ*.]

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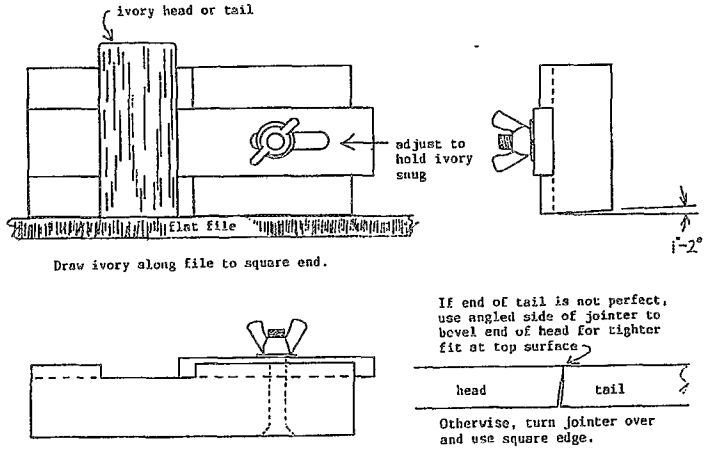

Figure 1

Ivory Keyboard Restoration

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If new ivory or an unused blank is to be used, both head and tail absolutely have to be filed to fit because the edges are rough. This is necessary to make a good square joint. A good joint can be made by careful filing, and then a good idea is to observe it through a three-power magnifying glass. Look at the joint, not only from the top but also from the side of the key. If possible, the joint should be cleaned with a dampened lint-free cloth. They are also oversized and require dressing down. Again, if the ivory is too thick it can be dressed down or sanded on the under side before gluing. Sometimes this works better if the ivory is not to be sanded after gluing.

When a tail is loose or missing along with the front, glue the tail down first. Always remember that the tail once in place locates the front correctly in the fore and aft position.

Care should be taken no matter what adhesive is used — don't let any of the glue seep into the joint. Keep the joint dry and free of any glue or it will attract dirt and soon become a black unsightly line. A clean, square joint will stay clean.

Glues/Adhesives

Several types of glues or adhesives can be used to attach ivory to the key.

Ivory wafers can be used and have an advantage since they give a white under-surface that adds quality and richness to the ivory if it is somewhat transparent. Sometimes cold hide glue can be used. The white glues (Elmers and Titebond), will hold the ivory, but sometimes have a tendency to discolor ivory. The cold hide glue can be made white by mixing titanium dioxide with it. Super glue can be used — (for a white under surface with super glue, first let a coat of the whitened glue dry and then add the super glue). Use contact cement only if nothing else is available. Sometimes it turns dark under the ivory and will defeat the purpose.

There were and are some key boards on old Steinway pianos where the ivory key tops were glued on without a wafer and no white pigment whatsoever in the glue. In this situation, the ivory was of such superb quality and so opaque that glue only was needed. Whatever glue was used really fused the ivory to the wood (no verification of type of glue). It is almost impossible to remove a damaged ivory even with heat! In this case, as with most cases where ivory heads have to be removed with heat, try to shield the tail from the heat so as not to char it.

Whatever adhesive is used, be sure to clamp the ivory while the glue sets or cures. Even super glue should be clamped to insure a good set. If possible leave the clamps on overnight. For a quick in-home repair, the super glue probably will work best or Duco cement — clamp if possible. The water based glues will make the ivory curl or warp if not clamped. Super glue or Duco cement will not cause the ivory to curl or warp. Again, keep the joint between the head and tail dry and free of any glue.

Sometimes, if an ivory pops off and the wafer underneath is relatively clean, the wafer can be slightly moistened with water (or even saliva). Then fit the ivory back in the proper place and clamp. The moisture re-activates the glue in the wafer and will usually hold.

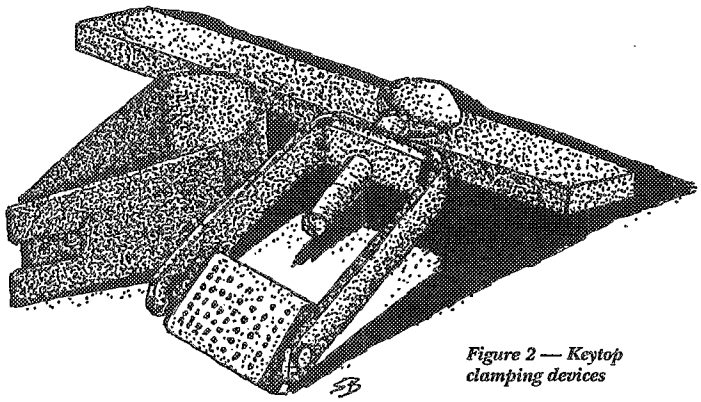

Figure 2 — Keytop clamping devices

When ivories have been replaced, there is always some filing and dressing down to be done. A coarser mill file used first and then a fine mill file as a finish-up on the key edges works fine. Files used on ivories should not be used for anything else. Since ivory is as hard as it is, files will dull and have to be replaced after a while.

With the completion of the repair of the ivory key board it is ready for the sanding and buffing process detailed previously.

Ivory — A Fascinating and Intriguing Material

There were approximately 22 grades of ivory — from 1, (which was the highest quality, with very fine and close grain lines) to 22, (which had wide grain lines and more transparency). Most piano keys were made with grades one to five. The finer-grain ivory was used on the better quality pianos — but toward the end of the ivory era most ivory used was of the lesser quality.

Ivory seems to be very sensitive to light. When a piano is left in a dark room with the fallboard covering the keys, the ivory will eventually darken. The keyboard usually will remain white if exposed to daylight.

Chlorine bleach should not be used on ivory because it breaks down the cells and causes it to disintegrate. Phosphoric acid can be used, and in some cases hydrogen peroxide. A commercial product — clairoxide, or "Miss Clairol" — can also be used.

Darkened old ivory can be cleaned and bleached by soaking in "clairoxide" solution for 24 hours, rinsed in warm water and spread out on paper towels to dry. The ivory will curl up, so turn them over and continued turning them over until dry. After drying for two to three hours they can then be clamped between two wood blocks to further insure they remain flat.

Dirty, old loose ivory can be also be cleaned by soaking 40 or 50 ivories in a quart or so of warm water and dishwashing detergent — agitate a few times and most of the dirt will loosen and the glue will soften on the back side. Rinse in warm water and spread out on paper towels to prevent curl and proceed as above, until dry and flat.

Restore the "White" To Those Ivory Keys

Richard Wagner, RPT
Portland, Ore., Chapter

During the past 12 years, I've done a good deal of work for one of this area's most prominent piano dealers. In helping to restore the large number of reconditioned "used" instruments which this company sells, I've often been faced with the challenge of trying to restore an otherwise beautiful, but badly yellowed, ivory keyboard to its original whiteness. Herein is a method which is quite successful.

This system achieves its effect by using a combination of ultraviolet light and very strong hydrogen peroxide to bleach the yellow out of ivory. In order to accomplish this task, you will need to obtain a few things which are not likely to be found in the ordinary piano shop, specifically: 30 percent hydrogen peroxide (H_20_2), and two fluorescent-type ultraviolet lights.

I purchased my H_20_2 in a 30 percent concentration from a local supplier specializing in science materials for education and industry. After telling them what I intended using it for, they recommended that I buy it in its stabilized form, explaining that the un-stabilized mixture could, if handled incorrectly, be explosive.

Once you've obtained this, combine (2) parts water and (1) part H_20_2, in a non-food container. This will yield an overall concentration of 10 percent H_20_2. Pour this 10-percent solution into a pump/spray bottle and add a few drops of liquid hand soap as a wetting agent. It is this mixture which you'll use to bleach the keys. The undiluted H_20_2 should be sealed, and stored in a refrigerator until needed for later usage. Note: If you are unable to purchase 30 percent H_20_2, adjust the amount of water in your mixture, until you are able to achieve an approximate 10 percent concentration.

At this point, it would be wise to warn that both the chemicals and the light source mentioned in this article, are potentially harmful to your health. Use adequate eye, respiratory, and skin protection. Heed all attendant warning labels. In addition, follow all advice offered by the professionals from

whom you purchase your materials!

The lights I use are two (4-foot long) Sylvania 350, 40 watt blacklights, serial# F40/350BL, purchased from a local lighting supplier. These are placed into an ordinary "light duty" fluorescent lamp fixture, the fixture itself supported at both ends (lights down) upon a workbench by two small sections of 2" by 4", these lying on their 4" dimension (see Photo 1). The keys being bleached will be placed directly beneath this light fixture.

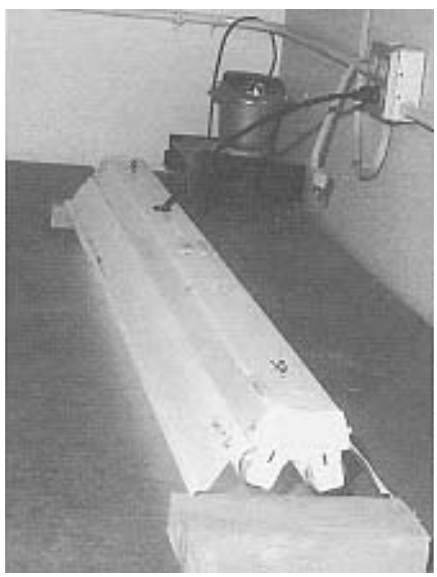

Photo 1

1. Using 320-grit (or finer) sandpaper, lightly sand the ivory keytops to be bleached. Following this, cover them with one layer of cheesecloth (available at local grocery stores). The purpose of the cheesecloth is to distribute the H202 evenly upon the ivory, thus preventing "puddling" of the chemicals, and over-bleaching of selected areas.

2. Using your pump/spray bottle, spray a fine mist of the 10 percent H_20_2 solution over the ivory.

3. Turn on the ultraviolet light, and push the keys to be bleached beneath it (see Photo 2).

4. Keep checking the keytops from time to time. As the H202 evaporates,

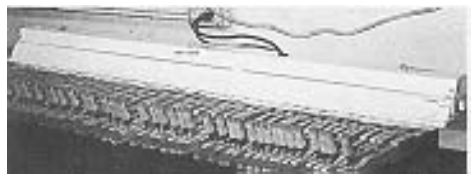

Photo 2

you will need to occasionally re-wet the ivory with this bleaching solution. Generally, satisfactory results are achieved in 48 to 72 hours. The whitening that actually takes place is more a function of the amount of H_20_2 applied than of the length of time the ivory spends under the light. As such, it does no harm to leave the keys under the light for a few days. In fact, the light should be left on at all times during the bleaching procedure, including overnight.

Warning: **It is possible to damage the ivory by over-bleaching. Do not use too much H_20_2!** If the grain in the ivory begins to look extremely white; if the ivory is already thin and begins to crack or lift; if the solution on top of the keys begins to look foamy — if in doubt — Stop! Keep in mind that you can always proceed further, if you wish, but you can't undo what you've already done.

5. When you're satisfied with the bleaching that has taken place, turn off the light, remove the keys from beneath it and wipe off any residue left on the ivory with a damp cloth.

6. It is now necessary to sand the keytops in order to smooth out any rippling or pitting which has been caused by the bleaching procedure.

Continued on Next Page

Restore the "White" To Those Ivory Keys

Continued From Previous Page

Although you may do this by hand, I generally use an orbital sander, supported upside down in a woodworking vise (see Photo 3). Use 320-grit wet/dry sand paper, apply a few drops of water, and sand each keytop just enough to smooth the surface. Usually about 30 seconds each will do. Be constantly vigilant that you don't over-sand and that the ivory remains flat and even.

Photo 3

7. Using a dry cloth, wipe off the resultant damp ivory-paste (see Photo 4) and buff out each key as you normally would (see Photo 5). Congratulations, you're finished!

A Few Last Words of Caution ...

Before undertaking this procedure on a customer's piano, experiment with some keys of your own first. Always inspect the ivory on any keyboard very closely before committing yourself.

Although the heat from the lights (about 82 degrees F.) and the bleaching solution does not normally cause the ivory to loosen, if the heads or tails are already getting loose, the bleaching procedure will cause them to lift more. So make sure you've allowed yourself enough time in your bid to reglue the loose ones. Also, remember that this procedure does remove material. If the existing ivory is already thin, proceed with extreme caution or not at all.

Overexposure to ultraviolet light may damage your eyesight. Do not look directly into the light source. It would be wise to wear sun glasses with U.V. protection, or to build some sort of shield using U.V. blocking plastic film (available through a scientific supply house).

Hydrogen peroxide in the concentrations listed above can be dangerous. Use proper eye, respiratory, and skin protection at all times.

Good luck and happy bleaching!

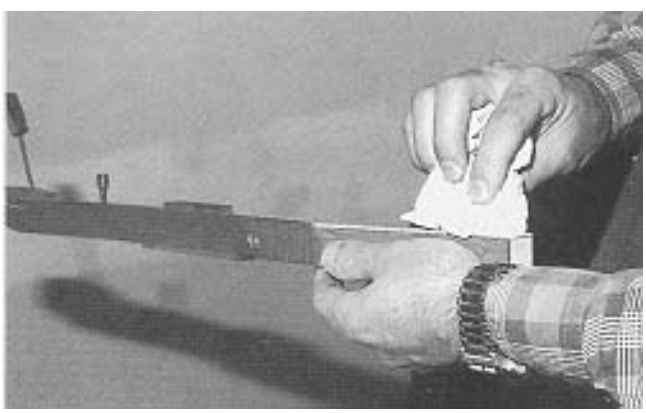

Photo 4, above, Photo 5, right.

Ivory-like Keytops From Beef Bones

Donald Bunch, RPT
Pamlico, NC Chapter

The April 1994 issue of *PTJ* included an article by Robert Bartnick, RPT, entitled "The Keys to Success." Bartnick's mention of Don Bunch's bone keytops has sparked some interest and raised quite a few questions on the matter. I would like to take this opportunity to thank Bob Bartnick.

First, allow me to furnish a brief history of this project. About 1,000 years ago, bone was used on organ keyboards. Pianos were not invented yet and ships did not sail to where ivory was obtainable. My, we have come a long way! As ivory became readily available it was used for keyboards. Ivory was easier to cut and carriage for slicing. I think ivory was considered a more valuable commodity, being wrestled from the mighty elephant instead of the leg bone left over from yesterday's stew.

When quality used ivory was available, I found an ivory keyboard to be a good selling feature on Steinway and Mason & Hamlin grands. The problem is that by the time you resurface the used ivory, it is just too thin. How thin is too thin and how thick is too thick?

Ivory keyboards manufactured in the 1900s have really not held up that well. However, look at the ivory keyboards (mostly on squares) made in the 1800s. Most of the latter are still in good shape, even though they're older than the 20th century ivories. Why? The ivory keytops made in the 1900s were .035" to .050" thick. The ivories used in the 1800s were .050" to .080" thick. The thinner ivories could not handle the humidity-induced dimensional changes of the wood keystick without splitting. They were also too translucent, requiring linen wafers and/or glue whitening. Furthermore, the .035" to .050" ivories were more subject to chipping by teething young'uns or gaudy rings of pianists. The .050" to .080" ivory, on the other hand, was more stable to humidity changes of the wood keystick. It also did not require linen wafers or glue whitening.

Ivory vs. Bone

Both ivory (tusk) and bone are crystallized calcium. Ivory tusks are more like antlers and hooves. None of these have a living blood supply. Bone is akin to teeth because these do have a living blood supply. Both tusk and bone vary in hardness and density from specimen to specimen and within a given specimen.

Through trial and error, I have found the large leg bones (femurs) from bulls weighing at least one ton or more, to be best suited for keytop manufacturing. The bull has denser bones than the cow (the greater muscle mass provides "functional stress" that results in a strong, dense bone structure, according to Dr. Steven Ainsworth). This bone is harder and denser than ivory. For reasons discussed earlier, I use a thickness of .070".

Both tusk and bone absorb moisture (perspiration from pianists' hands) and offer good traction for pianists' fingers. Plastic, impervious to moisture, therefore becomes slippery and oily feeling. I have said that ivory or bone is largely "jewelry" for the piano. Hey, face it, that sells! However, several of my more artistic clients have reprimanded me; they swear by the feel of bone keytops. I stand corrected!

Product Refinement

With much technical input from two orthopedic surgeons, Steven Ainsworth, M.D., and George Miller, M.D., I took a crash course in histology (the study of tissue). The docs furnished me with a group of enzymes that are used in pathology. These enzymes cleanse the bone to the state of pure crystallized calcium. For pathology purposes, this can show why a particular bone did or did not heal, and various disease states. For keyboard purposes, the enzymes render the bone to clean, white and beautiful key blanks.

Cost and Ordering Information

Cost for a bone keyboard is about $2,000, with half up front. I need the keyframe and all keys with bushing work completed. This assures a straight joint line.

For more information, write or call:

Bone Keyboards
Don Bunch, RPT
P.O. Box 1973
Washington, NC 27889
(919) 946-5418

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LESSON PLAN

Technical Lesson #22

Grand Regulation - Part 3: Hammer Travel, Angle and Spacing

By Bill Spurlock, RPT
Sacramento Valley Chapter

This monthly lesson plan is designed to provide step-by-step instruction in essential skills. Chapters are encouraged to use this material as the basis for special Associate meetings, or for their regular meeting program, preferably in a hands-on format. This method allows the written information to be transformed into an actual skill for each member participating.

In Brief:

This lesson will cover the proper hammer alignments necessary for achieving parts clearance, maximum power, and optimum tone. Participants will correct improper hammer-shank spacing, hammer traveling, hammer angle, and hammer/string spacing.

Getting Started:

In order to pursue any serious study of piano technology, one must obtain basic resources. Catalogs from several piano supply houses, both large and small, are essential. Besides offering the necessary supplies, their pictures and item descriptions are valuable sources of information. Piano manufacturers' service manuals are also essential sources of valuable information. Most are available at no cost. Most important to participating in this Lesson Plan series are the PTG Exam Source Books, both the tuning and technical versions. Articles in these books will serve as reference material for the lessons.

Hands-on Session Setup:

To teach this lesson in a hands-on format, you will need one or more grand pianos in good condition. New or good used pianos on a showroom floor are ideal. (Used pianos must not have grooved hammers, or tone problems will result from changes to hammer spacing.) The pianos should already have their keyframes located properly side-to-side and in/out, as described in Lesson #21.

Depending upon time and pianos available, this lesson may consist of participants working individually on separate pianos, or taking turns observing and adjusting on a single instrument.

Estimated Lesson Time:
2 hours

Tools & Materials Participants Must Bring:

For this lesson, participants should bring the following:

- medium Phillips and flat-blade screwdrivers.
- one flat-blade screwdriver with a 1/4" - 5/16" wide tip, ground thin (to fit between closely-spaced flanges).
- grand hammer spacing tool (Pacific #1348A, APSCO #16112, or Schaff #196).
- travel paper (Avery correction paper from a stationery store, or 180-grit sandpaper or gummed paper tape cut into 1/8" wide strips).
- a heat source, such as an electric heat gun, "gas match" butane fire starter, or disposable lighter.

Assigned prior reading for participants:
PTG Technical Exam Source Book, pages II.3 - II.7; November 1993 PT *Journal*, pages 28 - 31. A highly recommended resource is Yamaha's video & book set, *Grand Regulation in 37 Steps*, available from Schaff Piano Supply and Yamaha Corporation.

General Instructions

The goal of regulation is to provide the pianist with maximum power, repetition speed, and evenness of touch and tone. Hammer alignment and spacing are essential prerequisites: Each hammer must move straight toward the strings without veering (traveling) right or left; each hammer must align 90 degrees to the strings, not tilting toward the right or left (with some exceptions, noted below); and each hammer must be well centered to its unison strings (again, with some exceptions).

Hammer alignment and spacing involves a series of steps that must be done in a specific order:

1) The entire keyframe and action assembly must first be located relative to the strings, damper levers, and case parts, as described in Lesson #21.

2) Individual hammershanks are checked for even spacing along the rail.

3) Any hammershanks that travel to the right or left are corrected.

4) Hammershanks are "burned-in" (twisted using heat) as necessary to correct improper hammer angle.

5) Hammers are individually spaced to their unison strings.

Steps 2, 3, 4, and 5 are described below. These are typical procedures that might be done when prepping a new piano or in the course of regulating an older instrument.

Even Spacing of Hammershanks

Hammershank flanges usually have enough clearance in their screw holes to allow some side-to-side positioning. If not spaced evenly, adjacent knuckles may rub together. Also, adjacent wippens may rub together if they are aligned to unevenly-spaced knuckles. Thus, all parts spacing is made easier and rubbing parts are avoided by even spacing of hammershanks. It is actually the spacing of the hammershank at the knuckle, rather than the flange spacing, that is important, because the shank and knuckle are the moving parts.

Ideally, flanges would be spaced along the rail to give uniform spaces between all knuckles. Thorough attention would be paid to this step when installing new action parts or when doing a complete action regulation. However, a practical approach when prepping a new piano (and for this lesson), is to simply look for any shanks that appear to be close enough to allow rubbing. Most shanks have enough clearance between the flange birdseye and the inside of the shank fork to allow for slight side-to-side

play. Be sure to take this into account when deciding if any shanks are close enough together to rub.

Photo 1 (above): Here the fourth and fifth shanks are too close together, causing rubbing knuckles and limited clearance between their respective wippens. Correct by loosening the flange screw and shifting one or both flanges apart as needed (push the flange sideways with a screwdriver to unstick it from the rail if necessary). When retightening the screw, hold the shank so the hammer head is evenly spaced between its neighbors. Also, make sure the end of each flange is back against the lip on the action rail.

Hammershank Traveling

Hammershank traveling is important for two reasons. First, a hammer must move perpendicular to the hammer rail for maximum power and best tone. If the hammer moves in a sideways direction, some power is lost and tone is compromised as the hammer wipes sideways across the strings. Second, proper traveling reduces interference between neighboring hammers. When a hammer travels sideways it occupies a wider path as it moves toward the strings, and is more likely to rub an adjacent hammer.

Photo 2 & Figure 1: To check for traveling problems, slide a long smooth screwdriver under a group of shanks, then raise and lower the group slowly. (Raise the shanks only until they are about level; it is not necessary or useful to observe their motion above that point.) Looking at the spaces between hammer heads, watch for any that get narrower or wider. Determine which hammer is at fault, and make a chalk mark on the same side of the flange that the hammer travels toward.

To correct traveling, loosen the flange screw, tip the back of the flange upward, and insert travel paper between the flange and rail on the same side as the chalk mark. If using gummed or self-adhesive paper, place the adhesive side toward the flange. If using sandpaper, place the grit side toward the flange. The amount of effect can be varied by the width and position of the paper. The wider the paper, and the farther toward the front of the flange the paper is inserted, the greater the effect. Tighten the screw and recheck the travel before tearing off the excess paper. If the correction is too much, loosen the flange and slide the paper back out slightly. Never insert paper under both sides of a flange.

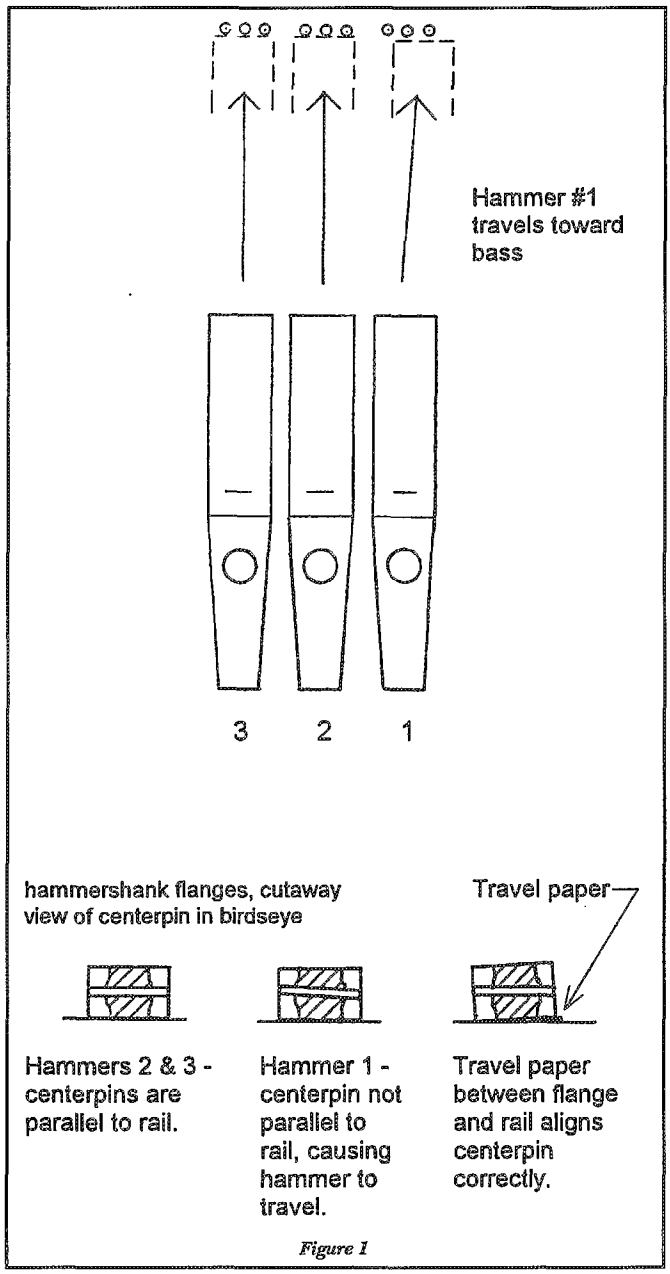

Figure 1

Burning-in Hammershanks

Adding travel paper under flanges during traveling will have tilted those shanks, causing their hammers to now lean to one side. Other hammers may also lean because their shanks have twisted, or because of improper hammer installation. To deliver the most power to the strings, and to minimize clearance problems, hammers should stand vertical, not leaning toward the bass or treble. Note: one exception to this occurs with closely spaced, sharply angled hammers in the bass and low tenor sections. In some cases leaning these bass hammers slightly toward the tenor and the tenor hammers slightly toward the bass will improve their passing clearance.

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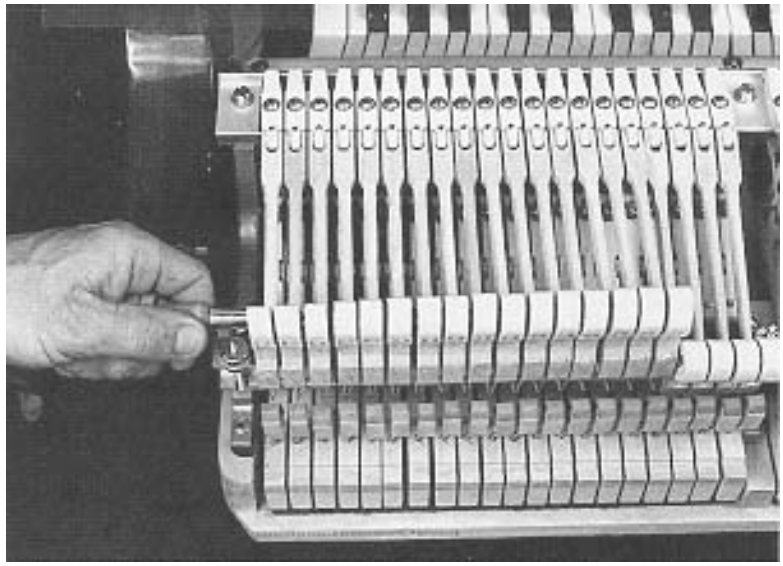

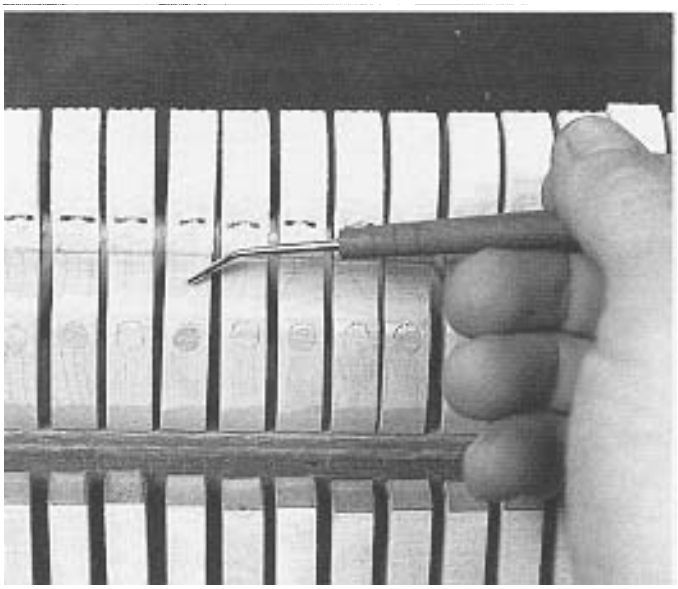

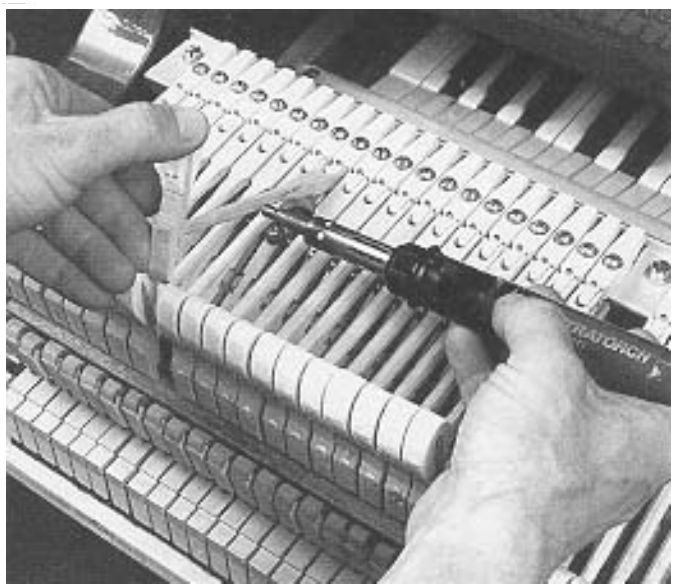

Photos 3 (above) & 4 (above, right): Support a group of hammers at approximately strike height and inspect for any that lean to one side, as pointed out in Photo 3. To correct, apply heat to most of the shank length. After a few seconds, twist the hammershank slightly past the correct position, remove the heat, continue holding the shank twisted for a moment until it has cooled slightly, and release.

Hammer-to-string Spacing

There are several considerations involved when spacing individual hammers to their strings:

1). If most hammers need to be spaced the same direction, relocating the key frame in that direction will minimize the number of individual hammers that have to be spaced, as described in Lesson #21.

2). Hammer spacing should be uniform, so that as the action is shifted with the una corda pedal, each hammer in the three-string sections will clear its left unison string at the same shift point. Thus a good check is to look for an equal amount of hammer showing to the left of each unison when the action is in the unshifted position. If spacing is erratic, some hammers may not clear their left string when shifted, and others may move too far and contact the next unison to the right. Of course, string spacing within each unison and between unisons in the capo (non-agraffe) sections should be even.

3). For most pianos, all hammers should be centered to their unison strings. One exception is Steinway, which specifies that bass hammers should be aligned slightly to the left, so both strings are still struck when the action is shifted, and that tenor and treble hammers should be aligned slightly to the right of center, minimizing the shift distance required.

4). In some smaller grands with sharply angled bass strings, the bass hammers must be spaced slightly to the left of center. Otherwise, they can contact the next higher unison when the action shifts far enough for the treble hammers to clear their left strings.

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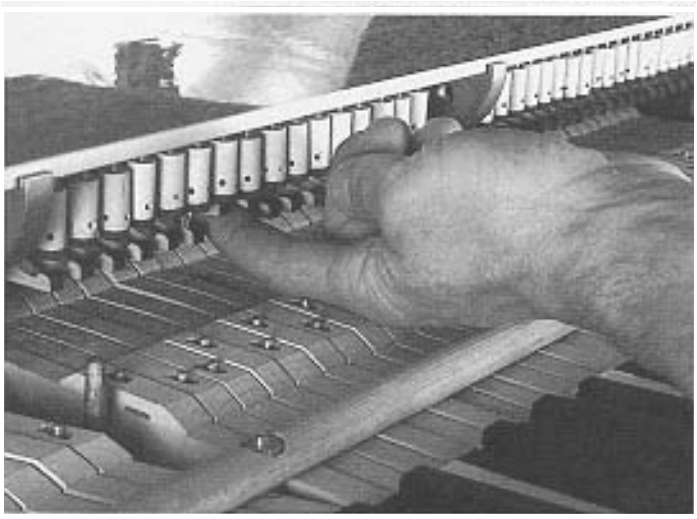

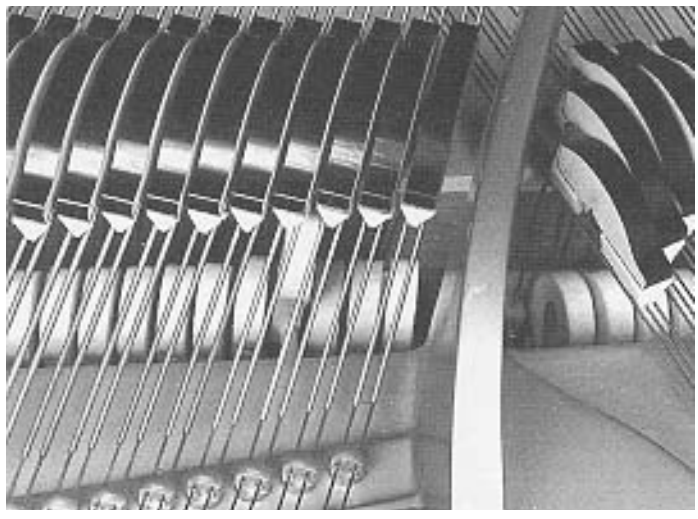

Photos 5 (above) & 6 (above, right): To check hammer/string spacing, raise hammers up close to the strings by lifting the jack tenders. By pressing the jack tenders into the let-off buttons, let-off is delayed and the hammers can be brought up to string height (assuming that let-off is adjusted fairly close).

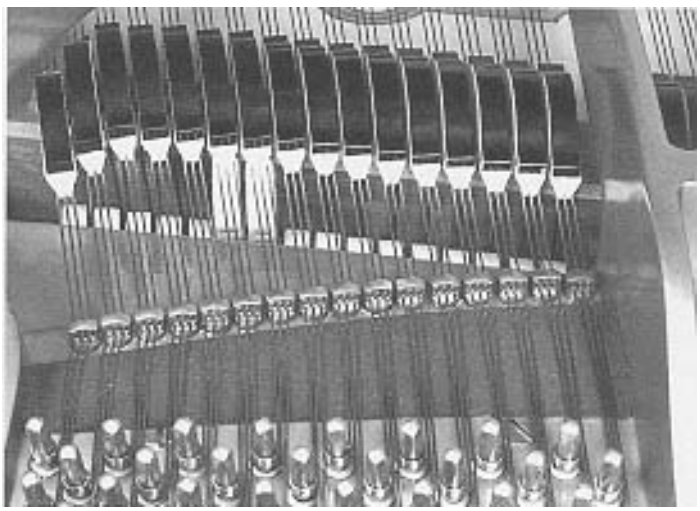

Photo 7 (left): Before deciding how to space the bass hammers on a small grand, check that they will clear the next higher unison when the action is shifted the proper amount for the tenor and treble. If necessary, bass hammers may have to be spaced off-center toward the left.

Photo 8 (right): If the flanges are V-shaped or narrowed at the end, they are most easily spaced using a flange spacing tool, as shown here. (The action is removed for clarity in this photo; the actual spacing is done with the action in the piano.) Flange screws should be slightly loosened first. Then each hammer is raised to the strings and spaced as necessary.

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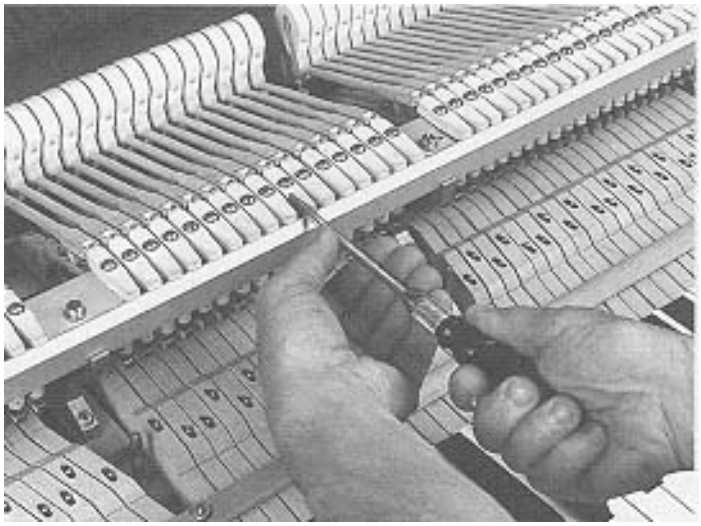

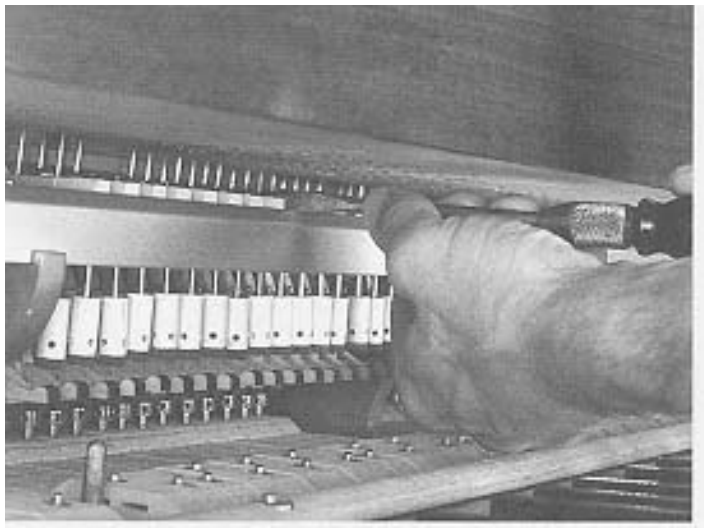

Photos 9 (above) & 10 (above, right): If a flange spacing tool is not available, or if the flanges are rectangular with only small spaces between them, hammers can be spaced by pushing against the side of the flange with the tip of a thin flat screwdriver. The screwdriver is used to push sideways against a single flange, not to pry between two flanges. This job is done with the action in the piano; Photo 9 shows the action removed for clarity only.

Flange screws must first be loosened slightly, just enough so they can be shifted but still tight enough to stay put until all hammers are spaced and the screws are retightened. If you have trouble making small movements when pushing the flanges by hand, try tapping the side of the screwdriver near the tip with a small hammer instead. The screwdriver must be thin enough to fit between the flanges, with the blade held flat against the side of a flange. If you find it slips out and scars the flanges, either the screws are too tight or the blade is too thick.

An alternate method of spacing is to mark the keys of any hammers needing spacing, making a chalk mark on the side of the key to which the hammer is to be moved. Then, slide the action out and space hammers according to the chalk marks, by loosening each flange screw, turning the flange, and retightening. This method works well but requires some trial and error and rechecking.

Note: Steinway pianos require slightly different hammer traveling and spacing methods, not covered here. This information is covered in the Assigned Prior Reading for this lesson.

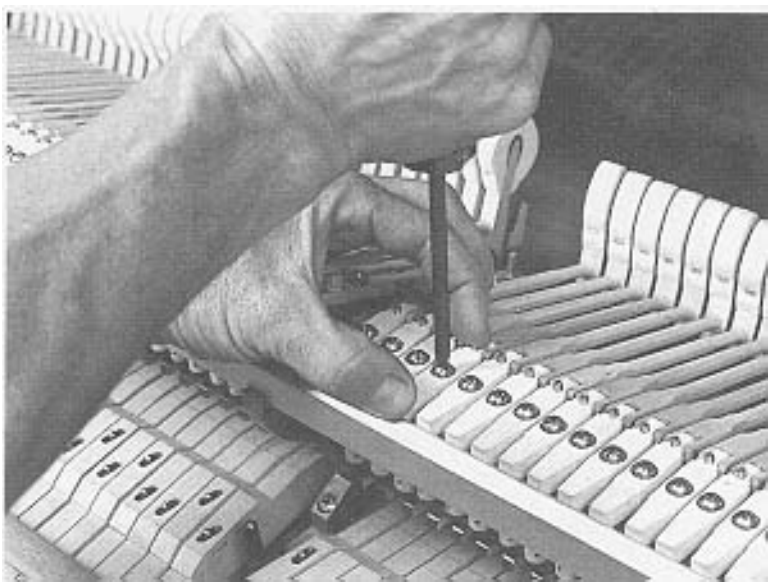

Photo 11 (left): After all hammers are spaced, retighten the flange screws. As you do, hold each flange as shown to prevent it from shifting while the screw is turned.

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Tuning Lesson #22

Treble: Part 2 — Checks and Balances

By Michael Travis, RPT

This monthly lesson plan series is designed to provide supervised practice of tuning skills as a supplement to independent study and practice. Chapters are encouraged to use this material as the basis for special Associate meetings, or for their regular meeting program. Each lesson is designed to take about one hour, with about four participants. Participants are assumed to have essential reference materials and tuning tools (see PACE checklist) and access to a well-scaled large upright or grand piano for independent practice.

In Brief:

This lesson consists of further practice tuning in the range of the treble, octaves 5 and 6. The previous lesson focused on the M3-M10-M17 treble octave test in conjunction with parallel M17s. This lesson will build on that and add the M6-M17 treble twelfth test, and focus on the dynamic balance between double octaves and twelfths in the treble as expressed in the relationship of test interval beat rates: M3 ≤ M17 ≤ M6.

The goal of these two lessons is not to persuade anyone to use all the tests, all the time; nor should anyone rigidly apply these tests to all pianos. We only hope that participants can incrementally improve their own treble tuning by learning to adapt a few of these tests and concepts to their own work, or by listening to what they're doing in a different way.

Background

As previously noted, there is broad agreement that it is possible throughout most of the treble on a decent piano to tune a middle path – achieving a fair balance between the single octave, the double octave and the twelfth, with no objectionable beating among these consonant intervals. This is the path we attempt to further illuminate here. We should bear in mind that this is a type of tuning appropriate for the PTG Tuning Exam, in which single octaves throughout the treble and high treble should be clean-sounding. This means, of course, that upper treble and high treble double octaves and twelfths will become increasingly narrow as you go up. More on that in the next lesson.

Achieving Balance in the Treble

As we tune upward in the treble we often find a conflict of interests between competing octaves on the one hand, and twelfths and double octaves on the other. Octaves that are too clean will give you flat-sounding double octaves and noisy twelfths. Good tuning here is a balancing act that simultaneously accommodates these consonant intervals as high as possible while extending the smooth parallel progression of the faster-beating M17s as high as possible (in this type of tuning, that means up through most of octave 6, where M17 beat rates progress more slowly, and can even begin to regress in octave 7). Twelfths that are very nearly pure seem to be a good compromise for all but the upper end of the treble on most well-scaled pianos. We can boil down this balancing act to two problems. We want to avoid leaving a note too flat or too sharp. Then we want to find the best place for it in the acceptable range.

To avoid leaving a note flat in octaves 5 or 6, we want to make sure the double octave is wide in octave 5 (M3<M17), tapering down toward pure (M3=M17) only as we reach the upper end of octave 6, and that all single octaves are wide at the 2:1 level (M10<M17). The M17 should not beat slower than the M3 in the M3-M17 4:1 double octave test, nor slower than the M10 in the M10-M17 2:1 single octave test. In octave 5, noisy fifths and quiet fourths trailing down from a note are another sign of flatness, though above octave 5 all fifths and fourths, while technically becoming increasingly narrow, start to sound okay and are not worth testing. In octave 6, double octaves up to the note being tuned will usually start to make a transition from slightly wide (M3<M17), to pure (M3=M17), and rarely, to narrow (M3>M17). Usually we want to have a double octave as wide as tolerable that does not cause excessive noise in the single octave, while minimizing the noise in the twelfth.

The M6-M17 Twelfth Test

One way to avoid leaving a note sharp in octaves 5 or 6 is to make sure the twelfth up to it is no wider than pure, which means the M6 should not beat slower than the M17 in the M6-M17 test. For example, to test the 3:1 twelfth, A3-E5, play the M6, C3-A3 vs. the M17, C3-E5, and compare beat rates. If the M6<M17 and the twelfth is expanded, then E5 may be too sharp. If the M6=M17 and the twelfth is pure, then E5 is probably okay. If the M6>M17 and the twelfth is narrow, then E5 may be flat. This test uses a 5:3 M6 vs. a 5:1 M17, with the test note an M6 below the lower note of the twelfth.

Noisy fourths and pure fifths trailing a note can also indicate sharp, as can a sudden jump in speed up to the M17 in the M3-M10-M17 test. If you find this, check the sound of the single octave, which may be beating on the wide side. In most of octaves 5 and 6, pure or very slightly narrow twelfths (M6≥M17) imply wide 2:1 single octaves and 4:1 double octaves, that while they should not be too wide to sound good, should be wide enough to avoid having the high treble sound too flat.

The M3-M17-M6 Test

If we can avoid leaving a note obviously flat or sharp, then we should have it in a pretty good spot. That brings us to this combination double octave-twelfth

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test. Using it, we will avoid leaving a note wider than a pure twelfth, or narrower than a pure double octave throughout octaves 5 and 6.

With double octaves no narrower than pure, the M3-M17 test intervals are related as M3≤M17, which translates to: the M3 beats slower than or equal to the M17. With twelfths no wider than pure, the M6-M17 test intervals are related as M6≥M17: the M6 beats faster than or equal to the M17. Combining these relationships into a single expression gives M3≤M17≤M6. Though useful for tuning in octaves 5 and 6, the relationship thus expressed must be understood in the context of the individual piano you're tuning and where you are in the scale. In octave 5, and the lower part of octave 6, we might say M3<M17=M6, meaning that double octaves tend to be slightly wide, and twelfths tend to be pure. From about F6 to B6, we would probably expect M3=M17<M6, meaning that double octaves tend to be pure, and twelfths tend to be slightly narrow.

For example, in tuning A6, F4-A4 should beat slower than or equal to F4-A6, which in turn should beat slower than or equal to F4-D5. Adjacent treble notes should show similar parallel relationships in this progression, as well as in the parallel M17 progression, though how a particular M17 beat rate relates to those of the M3 and M6 test intervals will depend on where you are in the treble, and what kind of octaves sound best there. There is a balance to be struck between the double octave and the twelfth in the treble, but it is not necessarily midway between a wide double octave and a narrow twelfth. In octave 5, you can usually tune twelfths pure, with double octaves wide. In octave 6, you can usually tune twelfths pure to slightly narrow, and double octaves slightly wide to pure. Fine tune with parallel M17s.

In summary, if the M17 beats slower than the M3 (narrow double octave) or faster than the M6 (wide twelfth), you likely have a problem with the note you're testing if that note is in octaves 5 or 6. If M3 ≤ M17 ≤ M6, then you're in the ballpark in the treble. In the lower part of octave 5, the M17 tends to be closer in speed to the M6, while in the upper part of octave 6, the M17 tends to be closer in speed to the M3. Unless referring to an individual piano, it's impossible to be more specific than that. You just have to play it by ear.

PACE
Professionals Advance through Continuing Education

LESSON PLAN

Chapter meeting set-up

These lessons are most conveniently taught to a small group of four or five. Each group should have its own piano and RPT instructor. Each piano should be in a quiet environment for close listening. Avoid using pianos that present serious obstacles to tuning, such as deeply grooved or misaligned hammers, string termination noises, etc.

This lesson requires advance work on a piano, preferably a well-scaled 6' or larger grand. It should be on pitch throughout, strip-muted and with a good single-string midrange tuning up to B4 that can be used as a foundation for tuning the treble, C5-B6. To avoid duplication of effort in preparing for this lesson, it may be a good idea to schedule it in conjunction with the previous lesson, which has the same set-up requirements.

Tools & materials participants must bring

Tuning hammer

Home study assignment for participants

Reading: Same as previous lesson. Practice all the tests covered in this and the previous lesson, using the practice outline included here.

General instructions

Divide the 24 notes in octaves 5 and 6 among the participants. The RPT instructor should briefly review the lesson plan. Each participant should have four to six notes to tune, about half in octave 5 and half in octave 6. Notes should be tuned in chromatic ascending order starting with C5, so that participants have at least two turns each. Those not tuning should be quietly listening so that all may benefit. Budget time so that you spend about twenty minutes or so on each oc-

Practice Tuning Octaves 5-6

Prerequisite: midrange C3-B4 should be in tune and strip-muted, treble octaves 5-6 should be strip-muted. Have your midrange tuning checked by an RPT to be sure it's good enough to work with.

1). In octave 5 you can tune primarily for clean-sounding octaves, checking only the fifth and fourth down from the note being tuned on the first pass. The octave and fifth should both sound clean, and a little better than the fourth. If the fifth sounds worse than the octave, then come up a little more, and if the fourth sounds too wild, come back down a bit. Tune in like fashion from C5-B5.

2). Go back to C5 and perform the M6-M17 test on the twelfth, F3-C5. Adjust C5 if needed to equalize the beats. Check the single octave C4-C5 and the double octave C3-C5 to be sure they're acceptable. If either seems to have too much movement, lower C5 very slightly and retest. Test all notes in like fashion from C5-B5. For practice, also check parallel series of M3-M17-M6 tests; be sure that adjacent tests sound similar, and confirm that no M17 is slower than its corresponding M3 (indicating a narrow double octave and a flat note), nor faster than its M6 (indicating a wide twelfth and a sharp note). Remember that in this octave, the compromise should favor a pure twelfth as much as the octave and double octave will allow.

3). Nitpick the C5-B5 area by playing parallel chromatic and whole-tone series of M17s, making minor corrections to smooth out any beat-rate jumps. For practice, check parallel series of M3-M10-M17 tests, and be sure that adjacent tests sound similar.

4). In octave 6 (and 7) the P5-P4 tests are not going to give you much useful information, so just stick with the single octaves, from C6-B6, tuning just slightly on the wide side of pure on the first pass.

5). Go back to C6 and play double octave vs. twelfth pairs, listening for equal beating (or equal purity). Use the M3-M17-M6 test to confirm the balance between double octaves and twelfths (favoring the double octave if necessary to keep the single octave sounding clean) and make corrections as needed. Though the beat rates will be fast in the M3-M17-M6 test, you should be able to make useful comparisons.

6). Starting at C6, nitpick the C6-B6 area as in step 3, with parallel series of chromatic and whole-tone M17s, and also check parallel series of M3-M10-M17 tests for uniformity, and make corrections as needed.

7). Recheck all parallel M17s, and make improvements where possible.

tave, or about five minutes for each participant on their first turn, and five more minutes on their second turn.

Each participant should first tune two or three octave 5 notes as single octaves, using only the P5/P4 comparison test. At this stage a good result would be clean-sounding octaves and fifths up to each note, with fourths that may be beating faster but not objectionably. Next, the participant should run the following tests on their notes; each test should be run on all the notes before going on to the next test: twelfth (M6-M17); double octave (M3-M17); M3-M17-M6; M3-M10-M17, and parallel M17. Twelfths should be as pure as the octaves will allow, but not wide. Double octaves and single octaves should be wide, but not objectionably so. Parallel tests should show similarity of relationships and/or gradual changes in beat rates.

The instructor should nitpick the octave 5 notes after C5-B5 have been tuned, running parallel tests and quizzing participants on how to make improvements. Take a few minutes and correct any serious problems, or have a volunteer do this. Proceed to octave 6. Each participant should first tune several notes by octaves, then run twelfth vs. double octave comparison tests and make corrections to equalize beats as needed, and finally run parallel M17, M3-M10-M17, and M3-M17-M6 tests to check uniformity of tuning and nitpick results.

When all octave 6 notes have been tuned, the instructor should take an additional few minutes to nitpick octave 6, with group participation. The group should then compare and discuss how the tuning tests for twelfths and double octaves sound in the lower part of octave 5 vs. the upper part of octave 6.

If a measuring device is available (an SAT with a free memory page would be ideal), you might want to measure the results of tuning octaves 5 and 6 to simplify the task of setting up the same piano for the next lesson, the high treble.

Note: *Do you find these lesson plans valuable? Do you have specific suggestions for changes or clarification? Please direct any comments or suggestions to the author c/o the* **Journal.**

TECHNO stuff

Richard Anderson, RPT • Chicago Chapter

R.I.P.

A piano technician is required to wear many hats. Along with tuner and technician, we must also be banker, accountant, purchasing agent, driver, proctologist (for lyre and trap work), lawyer, counselor, decorator, and salesman. As the average age of the piano population ages, we are more often forced to put on one of the more difficult hats to wear — that of mortician.

Condemning a piano is difficult for us, as well as the owner, in a number of ways, and must be done with sensitivity, pragmatism, and empathy. It is difficult to look at any musical instrument, no matter how bad its condition, and sentence it to make music no more.

It is also difficult to look at such a magnificent collection of fine woods, workmanship, and elegance of design, and say that it cannot or should not be repaired. It is very difficult to look at an old pile of parts that some folks have hauled home off the curb simply because that was the best they could afford, and tell them the piano requires piles of money they don't have to be usable for the children's lessons. And it is most difficult to look at a customer who has shared a great part of their life with an instrument and tell them that they must forget that friend and turn their attention to another.

Consider this case. A college music student buys an old upright for $100 out of someone's garage, and has her friends haul it up to her second floor apartment. She calls you in to tune it and find that funny noise that it started making a few days after moving it inside. Your examination reveals that the soundboard has several large cracks and is coming unglued from the ribs for several inches on either side of each crack. In addition, the board is coming unglued from the liner in several places. It is evident that the glue in the soundboard, which came out of a different pot than the glue in the action, back, case, etc., has reached the end of its bond life. It's not uncommon for joints from one glue pot in the factory to "mature" at a different time than other joints made from other glue pots. There are three possible types of repairs.

1). Try to re-make the failed joints, or stabilize them in the open position the best you can without disassembling the piano, knowing full well that the parts of the joints that haven't yet failed aren't far behind. It might be that the only thing holding the board together and in the piano is the strings. This repair is risky, temporary, and if poorly done, eliminates the possibility of properly repairing the board at a later date. This is something the customer might afford, but not something you want to stake your reputation on.

2). Unstring the piano, pull the plate, and rebuild the soundboard. Popping the board out and apart, and then cleaning and regluing the joints is a very sound and appropriate repair in this situation, and can be done for significantly less cost and messing about than replacing the board. A good all around plan, but the customer probably doesn't have this much money.

3). Replace the board. This will fix the buzz, but the cost will certainly exceed the finished value of this instrument, and the customer definitely doesn't have this much money.

There is, of course, a final option. If we eliminate all the options of spending money on this piano, that leaves spending money on another piano. In effect, condemning the piano.

Next month we'll discuss how to condemn the piano, who condemns the piano, and tips for emerging as the good guy, instead of the coroner in the process.

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

Cultural Differences

By Doug Kirkwood

The upcoming PTG annual convention in Albuquerque, N.M., will be coupled with the annual meeting of the IAPBT (International Association of Piano Builders and Technicians). This will present an opportunity for us to meet with our counterparts from other countries and get a perspective on how they approach their craft and the attendant similarities and differences. Because of our many cultural similarities, meeting with technicians from the UK and Europe should pose little problem apart from language. However, both language and cultural differences become more complex when meeting our guests from Asia, particularly the Japanese, Chinese and Koreans. Let us examine some of these cultural differences and discuss how to deal with them. Hopefully, this will make your interactions with our foreign guests more meaningful, productive and pleasurable for all.

There are two general guidelines when traveling to other countries:

1. Observe the social and business customs of the country you are visiting.

2. Take the lead from your host, if you have one, as to what to do, when to speak, where to sit, etc.

This does not say that you should compromise your own moral standards or business ethics. If there is a problem, you need to find a way around the problem without embarrassing your host or others with you or cause them to lose face. What is of little consequence in our culture may well be slight or embarrassing in an Asian culture.

"Ah, but we are not visiting another country, they are visiting ours!" you might say. Quite true; however, particularly for our Asian guests, this may be their first or second trip to the U.S. There will definitely be language difficulties in addition to social differences which could combine to make visitors uneasy and apprehensive, in spite of the excitement and anticipation of the trip. If we as hosts can be sensitive to this, and in addition accommodate some of their normal habits, the experience will be a richer and more positive one.

Both the Japanese and Koreans are peoples bound closely to tradition, appearance, and honor. They are a highly disciplined people with a tremendous energy and an ability to channel that energy to accomplish very aggressive goals.

Group travel is the norm. In fact, they act and think collectively. This is reflected in many of their more recognized and publicized characteristics. You see this in their loyalty to their companies, in the way industries are organized into large conglomerates actively ministered to and supported by the government — especially the Japanese — and in their fierce protection of their cultural heritage.

Being societies with strong, deep roots in a feudal past, honor, respect for nature and fellow man, politeness and formality are paramount in guiding daily life, also in guiding their interactions with others.

The Koreans exhibit these traits, but to a lesser degree. They have become more flexible and more "Western" than the Japanese, due in part to the strong U.S. presence in Korea and their desire to outdo the Japanese commercially.

Asians assume you are an honorable person of high standards; however, you can earn their disrespect. And once lost, regaining respect is very difficult. Preserving your honor, your family's honor, and most important of all, your country's honor is more important than your own life. In the US. we are very forgiving. We tend to help people recover honor. This can happen within a single lifetime. In Asia, this may take many generations.

What's the point? If we understand some of the background, the environment and the forces in which and with which Asians live, we should find it easier to figure out how to interact with them. Of course, they will be coming here expecting to learn and do things the "American way." But, this is still a very difficult transition, even for a short time — one that fails more often than not.

Well, what can we do to make our Asian guests' stay worthwhile?

There are some basic rules which, if followed, can make life much easier all around:

1). Be super polite and respectful, at all times. You don't have to mimic their actions, but be genuine in your response.

2). Don't be confrontational in your discussions. Forcing a decision or a definitive response could result in the breakdown of a relationship. It is considered offensive to show, publicly, that a person doesn't know something, particularly if it is important to the discussion.

3). Don't ask if someone under-

stands. The answer will always be "Yes!" To say "No" would be admitting weakness, or lack of preparation, etc. Watch body language and facial expressions. These will tell you if there is understanding. If not, try a different approach without either being obvious or demeaning.

4). Be very careful of your own language. Speak distinctly and slowly without being offensive. Above all, do not use double negatives. There is no such structure in most Asian languages, particularly Japanese and Korean. You can count on your meaning or intention being misinterpreted. Remember, not only is English not their first or, most likely, second language, your particular colloquialisms are not necessarily shared by the rest of the people they will meet. *(Note the double-double negative — an example of what not to do).*

5). Physical contact in public is considered offensive. This rule is relaxed, somewhat, for foreigners to allow for standard greetings such as shaking hands. Any other forms of touching are not tolerated. You would not, for instance, shake hands with a good friend and clasp his hand with both of yours, or grip his arm as well as sign of familiarity or respect. The Japanese accomplish this with the number and depth of bows when greeting and parting. Koreans do less bowing, but tend to be more verbal to accomplish the same thing.

6). Address your Japanese guests by their last name with "san" appended to it. Japanese names are written the opposite of ours — last name first, first name last. However, they will be introduced or introduce themselves using our convention — first name first, last name last. Only family members or incredibly close friends use first names.

7). When sitting and talking, keep your feet on the floor. Showing your soles to the person with whom you are talking is offensive.

8). Appearance is very important, reflecting personal pride. For planned business or social events, sloppy dressing is often viewed as being disrespectful. Their logic says that they were not important enough for you to dress well.

There are two other customs which are most important to know. First is the famous exchange of business cards. To Asians, the business card is an extension of that person and is to be treated with similar respect. When you first meet, there will be verbal introductions. Then you exchange business cards as follows:

- Offer your card with both hands, turned so that the other person can read it.
- After receiving the other person's card, study it for a moment, noting the name and title or position.
- If possible, make some flattering comment about the person's position or work; or ask a question that allows the person to speak favorably about his position or situation.
- Keep the card out in your hand until all introductions have been made.
- Exchange cards with everyone. Missing someone is an insult to them, saying they are not important enough for your attention.
- When sitting down to talk, even informally (for the first time), arrange the cards on the table in front of you (if there is one) in a flat pyramid such that the most senior person's card is on the top, etc.
- Do not write on their cards, or give one of yours which has writing on it.

The second custom is the giving of gifts. The Japanese are almost compulsive about giving their hosts gifts. In Japan, this also extends to guests in a business context. The gifts are meant to be symbolic and, thus, not expensive. Giving a very expensive gift will most likely embarrass the recipient and could cause hardship because of the need to reciprocate. The Japanese give low-cost, tasteful gifts elaborately wrapped in Japanese gift paper, tied with a bow. (In Japan, gift wrapping is an art in itself.) If you should receive a gift, thank the giver and open it later unless you are told to open it there. You will not be expected to reciprocate unless you travel to Japan. Then, you would be expected to give simple, elegantly wrapped gifts to the important people you meet.

Women are still second-class citizens in most Asian countries. They will often travel with their husbands and be present at functions. They may also partake in social discussions. In fact, they may even enjoy a bit of "liberation" when in the U.S. Nevertheless, remember that in their society, they are regarded differently than they would be here. Do not try to elevate them to a position of equality by word or action. Regardless of what you may think, this will only serve to offend your guests and destroy relationships.

White is a color often associated with death. Giving someone flowers is a gesture of respect, but giving white roses wishes death on the receiver. Stick with reds, blues or greens.

Both the Koreans and Chinese are much more flexible in their cultural expectations and adaptation. They seem to be more "Western." The Chinese have lived with the Western (British and American) presence for so long that they have adapted many of their habits and adopted many "Western" habits to the point where there may only be subtle differences — and running afoul of these is tolerated with understanding. The Chinese from Hong Kong and Taiwan tend to have a very good command of English, including many of our idiomatic expressions. Nevertheless, both the Chinese and Koreans should be treated according to the basic rules above.

Finally, when all else fails, two things will keep you out of trouble.

1). The Golden Rule coupled with a good dose of humility works.

2). Watch and listen, first; then act.

Take the opportunity to meet people at the IAPBT meetings. Not only does meeting people from different cultures expand your own experience, it also forces you to examine your own society, revealing what you may take for granted and strengthening your appreciation for both your culture and theirs.

Grand Illusions . . .
The Page for *Serious* Cases

Tune It or Die

By Joe Mehaffey

Game Review I recently obtained a copy of "Tune It or Die," the new computer game from Grand Action, the same company that produces the popular "Mighty Discount Piano Tuners" television show. This is a "first person" game — you see all the action from the combatant's point of view. The illusion of motion is quite amazing, and even nauseating if you're not used to it!

The premise is simple. You have just entered what looks like a medieval castle, except there are pools of radioactive waste everywhere. Your assignment is to find the piano and service it. Of course, a whole menagerie of mutants and aliens will try to stop you, and you have to kill them. It's pretty tough, when they're tossing fireballs and you've only got a case full of tuning tools. **(Hint: the end of a broken bass string can come in handy.)**

(Joe Mehaffey may be reached c/o Mark Stivers, RPT, of the Sacramento Valley Chapter)

UNIVERSAL COMPLAINT RESPONSE FORM

Thank you for your ☐letter ☐fax ☐phone ☐email.

- ☐ They all do that.
- ☐ It was that way when we found it.
- ☐ It was working fine when we left it.
- ☐ We'd be glad to fix it for $

Please feel free to ☐write ☐fax ☐phone ☐email anytime. We value your business. Now, please go away.

The Valley Technician Code of Ethics

Clip and save this list of principles in your wallet. You also might want to begin each business day by reciting them in front of your family.

- If I find any money inside a customer's piano, I will invest it wisely and not spend it on dumb things.
- If a customer wins a judgement against me in court, I will pay promptly and not try to leave the state.
- I will never strike a customer's child with anything harder than a rolled-up newspaper.
- If I kill or maim a customer's pet, I will replace it promptly with a similar animal.
- I will never criticize a fellow technician if there's any possible way he could find out.
- If a customer demonstrates ignorance on a point of piano technology, I will not call her an idiot, roll my eyes, or start laughing hysterically. Instead, I will patiently explain how much more I know than she does.
- If I ding the case of a customer's piano, I will promptly and neatly repair it with the appropriate Magic Marker.
- If I catch myself breaking any of these principles of conduct, I will slap myself really hard.

Promoting the Piano ... A Marketing Venture

By Alan Hallmark, RPT

Three years ago the Piano Manufacturers Association International (PMAI) started a revolutionary marketing concept in the piano industry: competitive piano manufacturers and retail dealers joining together in a cooperative effort to reverse a decade-long decline in piano sales by promoting the benefits of active piano participation within local communities. Since then the SPELLS program (Study of Piano Enhances Learning & Life's Success) has grown to include almost every major piano manufacturer, hundreds of piano dealers, members of the Music Teachers Association, and members of the Piano Technicians Guild.

The SPELLS program offers positive alternatives: it focuses on the needs of the consumers and the benefits of music-making; promotes a climate of civility among members of the piano community, with the understanding that everyone will profit from a less destructive marketplace; views every resident of your city as a potential music maker, with the desire and capability, who is waiting for you to remove obstacles and create opportunities for involvement.

What has been the early data from dealers who have participated in the program? The Music Trades reports in the March 1995 issue that piano shipment data for a three-month period in 1994 indicated a 50 percent unit increase over the previous year in markets where a SPELLS program was in effect. In comparison, shipments were down by 8 percent in markets that did not have a SPELLS program.

But how does increased retail piano sales relate to marketing yourself and PTG? As community awareness of the benefits of playing the piano climbs, not only will new piano retail sales rise, but a corresponding effect will be more inquiries about tuning, repairs, reconditioning and rebuilding. With each inquiry comes the opportunity to present your qualifications and membership in PTG.

SPELLS projects to enhance community awareness have included monster concerts, mall recitals, fund raising "play-a-thons" for charity, booths at home shows, school assemblies and programs in public libraries, as well as other high profile media events that can serve as a vehicle for distributing PTG information, publications about piano care and maintenance, and the value of using a qualified member of PTG for services.

"Can't our PTG Chapter sponsor these programs ourselves?" Yes, it is possible, however, these projects are usually very labor-intensive. The SPELLS program helps to spread the workload throughout the piano community so that no one person or group becomes overwhelmed by the challenge. In many cases it has been a member of the Piano Technicians Guild who has inspired their local piano community into action.

Getting Started

The inception of a SPELLS group comes about not only from a desire to expand sales, but from a genuine commitment to increase the importance of music in today's society. A working relationship (if it doesn't exist already) can start with a phone call to store managers/owners, and the presidents of the local Music Teachers Association and the local PTG Chapter. After the initial contact, arrange a time when all cooperative parties can meet at a neutral site. A casual breakfast or luncheon setting can help to break the ice and start the creative energy flowing. In following meetings, decisions can be made as to the type of project to undertake. Each community will have its own characteristic flavor, suggesting the type of project to begin. However, many SPELLS sites have found that a mall recital or play-a-thon, with its large number of participants, seem to gain the most benefits for the amount of time required.

The advantages of a mall recital are: it gives students an informal, less stressful opportunity to perform in public; serves to encourage non-players to consider playing the piano; presents the Music Teachers Association, The Piano Technicians Guild, and local piano dealers with the opportunity to promote their organizations and distribute information on piano lessons, service, and sales; gives the mall retailers increased traffic; promotes networking and expansion of business contacts; if you are working with a charity, it helps a noble cause; and because of the sheer number of participants, it is a natural draw for local media coverage.

If a mall recital becomes the medium for your group, then some decisions as to who, why, when, where, and how to proceed need to be examined in detail to insure a smooth running operation.

Who will be the performers? Will you allow only the music association member teachers and their students, or do you open the registration to any interested pianist? This will be dependent upon the size of your community and the number of players needed to fill the one-, two- or three-day event.

Will you work in conjunction with a charity or go it alone? Some objections to charity involvement include: the benefits of playing the piano are important enough to stand on their own; students and their parents are already bombarded with fund-raising from school, scouting, team sports, etc.; on-site donations pose a security risk; helping with fund-raising can be more time consuming.

Considerations for working with a high profile charity may include: charities have connections to local media and can open doors where an individual group can't; charity fund raisers are professionals in marketing and can add input into your planning and provide access to

Continued on Next Page

Promoting the Piano...

Continued from Previous Page

wholesale promotional items and free special event liability insurance coverage (which can cost as much as $300-$600); more all-around publicity of the event and free advertising through public service announcements; fund-raising for charity can be accomplished through pledges by the students ($ / measure(s)) and many charities will voluntarily oversee the pledging procedure and collect the pledged donations; the annual year-end television telethons provide another opportunity to publicize your cause of promoting the piano while making the presentation of the donation check in front of a large television viewing audience.

When is the most suitable time of year? Many factors go into this decision. When will students be prepared but free from other recitals or contest dates? When can the stores best participate without disrupting retail sales? When will the mall allow your "invasion?"

If there are several area malls, submit your proposal to the marketing department of the mall that is best suited to your needs and shows a willingness to cooperate with: your choice of desired dates; placement of pianos, chairs and tables; approves of the literature to be distributed; furnishes mall advertising and mall press releases; and provides security for materials left overnight as well as escorts for the carrier(s) who transports the on-site donations to their vehicle.

How do you put this all together?

Some factors to consider are: on the day of the event show up early to insure that the piano(s) are tuned (a well prepared concert grand can be quite impressive to both students and teachers as well as passersby); the tables are in place; and all signs, banners and hand-out materials are set out; if you are working with a charity, position donation bins in highly visible and secure areas; if a drawing is part of your fund raising, make sure that the item(s) is prominently displayed and the area of ticket sales is near the information table, though providing an item for a drawing will increase your expenses; however, the interest generated will bring more people over to chat and inspect the available information brochures.

It works well to have the performers' registration table and staging area separate from the information tables. Of course the mall will dictate much of your event set-up due to fire safety regulations, and you will have to conform to their requirements.

Name tags for each participant, and a "who's performing now" board add extra work but they are big hits with the students and audience family members. Having a video camera connected to closed circuit TVs located around the stage gives the crowd a view of the performers' hands on the keyboard and could be another source of fund-raising through sales of videos. Throughout the day you may have "special attractions" spaced between the regular performers. Such activities as an on-site demonstration of a piano lesson; dismantling or setting up a piano; and having celebrity performers (local television and radio personalities, professional musicians who are well known throughout the community, or well-known professional athletes who love to play the piano as well as play their sport) serve to increase media interest.

Mall Recital Task List

1). Choose optimum date and mall site.
2). Select a high profile charity.
3). Send out student sign-up lists and pledge kits to teachers and stores as soon as possible.
4). Arrange for the delivery of the pianos.
5). Compile materials for handouts and prepare signs and displays.
6). Coordinate work schedule for registration and information tables.
7). Schedule performers.
8). Prepare press releases, and arrange interviews and public service announcements.
9). On the day of the event, arrive early to assure desired stage set up.
10). Prepare for after-event publicity opportunities.

Rather than let the student performers choose their playing time, assign blocks of time to each participating teacher and let the teacher be responsible for informing their own students of the scheduled time. It is also a good policy to require participating teachers, technicians and store personnel to commit to a time to work at the booths or help direct students on and off the stage, and to pass out the promotional giveaways such as certificates of participation, T-Shirts, bumper stickers, etc.

How much of a budget will you need for this event? This will depend on numerous factors. Will your group be responsible for event liability insurance? How many signs and banners will you need and how many mailings will you send out? Will you have to rent pianos? Will you buy additional advertising? What cost per performer are you willing to spend for promotional giveaways? In general, you can expect a moderate budget ranging anywhere from $600 to $ 2,000.

Starting a SPELLS group and sponsoring a mall recital is quite a time-consuming undertaking. However, you will find that not only will your new professional contacts be beneficial for your business, but you will make new friendships as well.

During the past winter NAMM Show, four leading SPELLS groups were recognized by the PMAI with awards for their efforts in promoting the piano: the Dallas/Fort Worth Piano Association; Madison Area Friends of Piano; Milwaukee Area Friends of Piano; and the Piano Music Association of Richmond.

For information concerning the SPELLS program contact Brenda Dillon, 4020 McEwen, Suite 105, Dallas, Texas 75244-5019. Phone (214) 233-9107 Fax (214) 490-4219.

An old Chinese proverb says that the best time to plant a tree was 20 years ago. The second best time is today.

Call for Papers

The American Musical Instrument Society will hold its 25th annual meeting at The Shrine to Music Museum, the University of South Dakota, Vermillion, May 16 - 19, 1996.

To mark the beginning of the society's silver-anniversary year, the program committee plans to organize each session consisting of several papers exploring important themes in current musical-instrument scholarship. The specific subject matter of each paper, however, may be about any type of instrument from any historical period, geographical area or cultural milieu. Diversity is encouraged.

It hopes to hold sessions on topics such as: Underlying Concepts of Instrument Design (e.g., proportions, local units of measurement, "instinct," copying or scientific research); Gender Issues (e.g., sexual symbolism in instrument design or decoration, cultural association of particular instruments with women or with men, women instrument makers); Attribution and Dating of Historical Instruments; Ritual, Religious and Symbolic Use of Instruments; and Musical Instruments and the Visual Arts (e.g., iconography, decoration, artists as instrument makers).

Group submissions of proposals for sessions consisting of several papers addressing similar broad topics will also be welcomed. Proposals for individual papers, lecture demonstrations, panel discussions, etc., on other topics may also be submitted. Each presentation should be limited to 20 minutes, but requests for longer presentations will be considered.

Two copies of a typed abstract no longer than 250 words, accompanied by an autobiographical statement of 100 words or less, and a list of necessary audio/visual equipment must be received by Nov. 15, 1995. Proposals for group session should include an abstract and biography from each participant. Each abstract will be evaluated on its own merit. Send materials or inquiries to John Koster, The Shrine to Music Museum, 414 East Clark St., Vermillion, S.D. 57069.

Following the Florida State Seminar in Orlando April 21-23, a group of seminar participants visited Golden Hammer winners Fred and Mimi Drasche and Jeanette Jellen, widow of Golden Hammer winner Steve Jellen, in Daytona Beach. Pictured are (clockwise from front left) Fern Henry, Bill Spurlock, Vivian Brooks, Jeanette Jellen, Larry Goldsmith, Evelyn Smith, Jim Bryant, Wally Brooks, Gina Carter, LaRoy Edwards, Fred Drasche, Mimi Drasche and Ray Chandler.

Half Day Tour Option ... Sandia Peak Tram

A tour to Sandia Peak is being offered as part of the International Association of Piano Builders and Technicians. The tour costs $40 and is open to anyone. Individuals interested in taking the tour can sign up when they register for either the PTG annual convention or the IAPBT convention.

Board your deluxe coach at 1 p.m., be served a box lunch, and then head down historic Route 66 as you make your way to the Sandia Peak Tram. The tram is the world's longest free-span cable tram, and offers magnificent views 2.7 miles above deep canyons. You will "fly" through four of the seven life zones as your make your way to the top. Viewing these life zones is equivalent to a trip from Mexico City to Alaska. Once atop Sandia Crest, you will marvel at 11,000 square miles of breathtaking scenery.

Once back at the coach, you will be taken back to your hotel for arrival at 5 p.m.

IAPBT Schedule

July 20	Dinner
July 21	Dinner
July 22	Luncheon
July 23	Luncheon or tour to Sandia Peak (includes lunch)
	Banquet
July 24	Luncheon business Meeting
	Symposium
	Banquet

Corrections & Clarifications

In Jim Ellis's article "Tuning Forks: Accuracy, Stability and Practical Applications," published in the May, 1995 issue, please note that footnotes 1, 2, 3, and 4 and the caption paragraph under Figure 1 were all part of the text and should be read as such if one is to understand fully the procedure that was used for Jim's measurements.

Also, on page 31, column 2, line 7, the figure "3.75 Hz." should read "3.75 MHz" and on line 24 of that column "+ one" should read "plus or minus one." In column 3, last paragraph, the phrase reading "the maximum counting interval of my counter" should be contained in parentheses. We apologize for any confusion that may have resulted from these errors.

The following are corrections to the PTG Membership Directory published in April. Please be sure to update both the alphabetical and regional listings.

Paul Monachino .....phone: 716-377-1904
Gregory Pond .....phone: 810-682-2268
Myron Shain .....phone: 305-344-1200
Dean Thomas .....phone: 412-652-5333

Richard Bittner .....e-mail address: HXHP60A@PRODIGY.COM
Thomas R. Young....e-mail address: TRYRPT@IX.NETCOM.COM

James Sivel .....chapter: #190 - Southeastern Pennsylvania
Robert Smit .....chapter: #062 - Toronto, ON

EVENTS CALENDAR

All seminars, conferences, conventions and events listed here are approved PTG activities.

Chapters and regions wishing to have their function listed must complete a seminar request form. To obtain one of these forms, contact the PTG Home Office or your Regional Vice President.

Once approval is given and your request form reaches Home Office, your event will be listed through the month in which it is to take place.

Deadline to be included in the Events Calendar is at least 45 days before the publication date; however, once the request is approved, it will automatically be included in the next available issue.

July 19 - 23
PTG 38th ANNUAL CONVENTION
& TECHNICAL INSTITUTE
Council Meeting July 18-19
Hyatt Regency / Albuquerque, NM
Contact: PTG Home Office
816-753-7747

August 14
NORTHERN CALIFORNIA
AREA EXAM BOARD
Tuning & Technical Exams
Location: Skyline College
Contact: Russell Brown
408-429-5453

September 30
POMONA VALLEY ANNUAL
SEMINAR
Location: Unknown at this time
Contact: John Voss
2616 Mill Creek Rd.
Mentone, CA 92359
909-794-1559

October 5 - 8
NEW YORK STATE—
NYSCON
Howard Johnson Plaza Hotel
Oakville, ON CANADA
Contact: John Lillico
605-200 Queen Mary Drive
Oakville, ON L6K 3L1
800-469-7266

October 12-16
TEXAS STATE
ASSOCIATION SEMINAR
Clarion Hotel
Richardson, Texas
Contact: Thom Tomko
114 S. Greenstone Lane
Duncanville, TX 75116
214-780-0143

October 20-22
CENTRAL EAST
REGIONAL SEMINAR
Mariott Hotel
Milwaukee, WI
Contact: Dave Hulbert
4760 N. 158th St.
Brookfield, WI 53005
414-781-6343

November 3-5
NORTH CAROLINA
REGIONAL CONFERENCE
Omni Hotel
Durham, NC
Contact: Richard Ruggero
3504 Fairhill Drive
Raliegh, NC 27612
910-787-7123

RPT Ranks Grow in May

REGION 2

301 ATLANTA, GA

CRAIG MILLER
460 HARBER CIRCLE
DALLAS, GA 30132

REGION 4

601 CHICAGO, IL

CHARLES R. TERR
8 OLD CREEK ROAD
PALOS PARK, IL 60464

In Memory

MAYO WEISFLOCK, RPT
SOUTH DAKOTA

DENNIS NICHOLSON, RPT
SOUTH BAY, CA

New Members In May

REGION 1

186 POCONO NORTHEAST, PA

FRANK BISSOL
RR 1, BOX 81C
UNIONDALE, PA 18470

191 PHILADELPHIA, PA

ALBERT E. BOYD
27 WALNUT ROAD
WALLINGFORD, PA 19086

REGION 2

212 BALTIMORE, MD

JAMES E. TODHUNTER
10854 SANDRINGHAM ROAD
COCKEYSVILLE, MD 21030

PEGGY K. WHITE
7508 MIDAS TOUCH
COLUMBIA, MD 21046

301 ATLANTA, GA

BLAKE M. COOPER
1610 NORTHEAST EXPWY.
ATLANTA, GA 30329

MARK A. LADD
109 DONAREE DRIVE
ANDERSON, SC 29625

REGION 3

771 HOUSTON, TX

JOYCE L. PLASTER
2210 BRIARVIEW
HOUSTON, TX 77077

JAMES M. TAYLOR
11002 MONTVERDE LANE
HOUSTON, TX 77099

JOHN J. WIDASKI
2510 RAY
PEARLAND, TX 77581

782 SAN ANTONIO, TX

RUSSELL W. NORLIE
215 W. BROADVIEW #2625
SAN ANTONIO, TX 78228

787 AUSTIN, TX

KELLYE R. SCHUM
7493 CHEVY CHASE DR.,
#205
AUSTIN, TX 78752

REGION 4

445 YOUNGSTOWN, OH

MARGARET E. DERICO
717 YORK STREET
N. BLOOMFIELD, OH 44450

452 CINCINNATI, OH

JANET S. FRISA
2500 SPRINGDALE ROAD
CINCINNATI, OH 45231

600 WAUKEGAN, IL

BRUCE E. ZALE
564 DEERE PARK CIRCLE
#106
BARTLETT, IL 60103

601 CHICAGO, IL

TIMOTHY S. FOSS
46 W.009 KESLINGER RD.
ELBURN, IL 60119

SAMUEL Q. GROSSNER
2841 W. ROSCOE
CHICAGO, IL 60618

REGION 5

553 TWIN CITIES, MN

JON P. ROSS
450 W. MCKINLEY STREET
OWATONNA, MN 55060

REGION 6

945 GOLDEN GATE, CA

KWANG JEN
551 CURTIS STREET
FREMONT, CA 94538

950 MONTEREY BAY, CA

DOUGLAS D. BUTLER
2626 SAN JUAN ROAD
HOLLISTER, CA 95023

951 SANTA CLARA VALLEY, CA

DAVID C. SPICER
805 EDEN AVENUE
SAN JOSE, CA 95117

REGION 7

594 MONTANA

GEORGE L. BAKER
30 REINIG STREET
BELGRADE, MT 59714

AUXILIARY EXCHANGE

Dedicated To Auxiliary News and Interests

President's Message

By now you should be packing your bags, looking forward to traveling to Albuquerque in just a few days. This *Journal* is scheduled to come out just prior to our convention in Albuquerque.

July can be quite warm in Albuquerque, so be sure to bring your light clothes; however you may be surprised by a cool evening. Albuquerque is approximately one mile above sea level and Santa Fe, our tour destination, is approximately 7,000 feet above sea level. Please be prepared for those altitudes and don't try to do too much as you may soon run out of breath.

There are many museums and art galleries throughout Albuquerque and New Mexico. There are also Indian pueblos and reservations to visit. If you like a little gambling you might find your hearts desire on some of the reservations. There is a tram ride up to the top of the mountain where one is said to pass through all four seasons on the way. You may actually find snow at the summit. You will certainly find the most panoramic, long distance viewing you may have ever seen from the ground. You may want to even try an early AM hot air balloon ride for a real thrill.

I hope you like chili peppers because chilies are the name of the game for your dining pleasure throughout New Mexico. Chilies don't have to be hot; they can be mild like a bell pepper or they can be like fire and everything in between — your choice.

New Mexico, Albuquerque, Santa Fe and the entire region are truly unique. The upper desert will have many surprises for you if you haven't been there before.

This year's convention is an international affair, which is a rare event in the United States. You will be given the opportunity to meet tuners and their spouses from all parts of the world, including Japan, Korea, Germany, England, New Zealand, Canada and many other countries, most of whom speak English to some degree. I am sure they will enjoy sharing with you their stories, as you will with them.

Stay for the International Banquet on Monday evening for a time you will cherish and remember forever. I attended an international conference in Japan in 1989 and cherish those times even today.

I am looking forward to seeing some of those people I met and came to enjoy on the PTG Asian Tour in 1989.

This is your last call for placing items on the agenda for the council session. Please fax your comments and recommendations to me at (818) 703-1781. I will do my best to accommodate you. This is your association and my theme is and continues to be, "More Fun For Everyone."

See you in a few days.

— L. Paul Cook

Edwards Elected President of MTNA

Ruth S. Edwards of Durham, N.H., has been elected president of the Music Teachers National Association.

Elected with Edwards in May were: President-elect L. Rexford Whiddon of Columbus, Ga.; Joan Reist of Lincoln, Neb., as the new vice president for membership; Sharon Lohse Kunitz of Albuquerque, N.M., as vice president for professional activities; and Kathryn B. Hull of La Quinta, Calif., as treasurer.

Edwards is a former associate professor of music at the University of New Hampshire, and in her faculty role she conducted master classes and workshops in performance, pedagogy and performance stress. She holds undergraduate and graduate degrees from Northwestern University.

Whiddon is the chairman of the Schwob Department of Music at Columbus College. He holds a bachelors and masters degrees from the Eastman School of Music and pursued doctoral study at Indiana University.

Reist is the coordinator of piano proficiency and piano pedagogy at the University of Nebraska-Lincoln School of Music. She earned her bachelors and masters degrees from UNL, and teaches courses in keyboard skills. Reist also serves as the coordinator of The Academy, UNL's integrated studies program for first-year music students.

Kunitz is currently an independent music teacher and has taught at both the public school and collegiate levels. She holds degrees from the University of Colorado and the University of Denver.

Hull, who once served on the faculty of the College of the Desert in Pal Desert, is an independent piano and theory teacher. She is an active arts consultant, specializing in grant writing, budgeting, fund-raising and board development.

Founded in 1876, the 24,000-member MTNA is the oldest professional nonprofit music organization in the U.S.

CLASSIFIEDS

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

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

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

Send check or money order (U.S. funds, please) made payable to Piano Technicians Journal, 3930 Washington, Kansas City, MO 64111-2963.

FOR SALE

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

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MUSEUM QUALITY 1857 CHICKERING, 7 octaves, rosewood, cocked hat, parlor grand with original matching stool. Soundboard and bridges in excellent shape. Call for pictures and price, 414-622-4994; or write: Route 1, Box 307-5, Wild Rose, WI 54984.

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LITERATURE

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SERVICES

STRAIGHT SIDES, SQUARE FRONTS and crisp notches are the benchmarks of our quality key recovering. Tops with fronts $100 plus return shipping and insurance. Call or write for free list of our key and action restoration services. Yvonne Ashmore, RPT and Associates, 12700 La Barr Meadows Road, Grass Valley, CA 95949, 916-273-8800

KEY BUSHING: We use over 20 different sizes of Spurlock Precision Cauls. Send the micrometer measurement of the key pins and we will give you a perfect fit. Both rails high quality felt $75.00 or leather $80.00 plus return shipping and insurance. Write or call for free price list of our key and action restoration services. Yvonne Ashmore, RPT and Associates, 12700 La Barr Meadows Road, Grass Valley, CA 95949, 916-273-8800

ADD ADDITIONAL $'s to your income. Rebuild player pianos for your clients. Send us the player parts. You restore the piano and we will return the mechanism in restored condition. We guarantee our work. For more details, call or write: Jim Brady, 2725 East 56th Street, Indianapolis, IN 46220, 317-259-4307

FOR THE HIGHEST QUALITY GRAND PIANO REFINISHING call ADEPT of Ft. Myers, FL. Bill Collins proprietor, 32 years in the craft. Licensed for 11 years at this same location. Specializing in exquisite, high quality and high gloss, lacquer finishes. Color and natural finish matching, case restoration, and invisible repairs. PH. 813-275-7170.

PLAYER PIANOS REBUILT, BOUGHT & SOLD. Estimates given at home and systems re-installed or send in mail. Serving Georgia to New York. Nicholas Fiscina, Ph. 800-862-2138.

SOUNDBOARDS INSTALLED, topsides rebuilt. Bridge-conformed, scale-diaphragmized boards with truly quartersawn ribs (sitka, eastern, or sugar pine). You send us the case, we'll return you a piano. Quality's the bottom line. David G. Hughes, RPT. 410-429-5060. Baltimore.

REFINISH PIANO HARDWARE in nickel, brass, or chrome. Metal finishing specialists for over thirty years. Parts shipped back to you in 2-3 weeks. Rush jobs can be accommodated. Whitman Company, Inc. 356 South Ave., Whitman, MA 02382. 1-800-783-2433.

STEINWAY, MASON & HAMLIN and other high quality piano re-manufacturing specialists. Our commitment is to achieve each individual instrument's performance capability. This is achieved through the finest raw materials, processes and craftsmanship. The experience of over fifty years of manufacturing processes and concert service to the greatest pianists can be offered through no other restoration facility. Please contact Peter Mohr at 603-624-2077 for more information or a quotation.

SENECA PIANO KEY. Quality key services at competitive prices. Sharps replaced, key bushing and the finest key recovering at any price. Write or call for price list and information on quick return of your key work. Seneca Piano Key, Ted Oberhaus, 4977 Frontenac Road, Trumansburg, NY 14886; 607-387-3095

PIANO HARDWARE REFINISHED. Lacquer finish or nickel plate finish. Craftsmanship and finishes are guaranteed to factory specifications. Delivery 2-4 weeks. Brass on Ivory, 302 Linden Avenue, Edgewater, MD 21037; PH. 410-798-6536.

RESTORATION OF CARVED WORK, turnings, inlays, and marquetry, including repair of existing work and reproduction of missing pieces. Edwin Teale; 18920 Bridgeport Road; Dallas, OR 97338; 503-787-1004.

52 PIANO KEYS RECOVERED— .075 tops with fronts (molded plastic) - $95.00; .050 pyralin - $100.00; .060 pyralin - $105.00. Gloss sharps (3 1/2") - $50.00. Keys rebushed: premium cloth - $75.00; leather - $95.00. Other services available. Call or write for price list. FREE return freight on prepaid orders of $50.00. Walker Piano Service, 554 State Route 1907, Fulton, KY 42041, 1-800-745-6819.

TRAINING

WELL-TEMPERED TUTOR. Learn to tune by ear with your Macintosh computer. Use pre-programmed temperaments or create your own. If you have trouble hearing beats, this program can isolate the beats for you. Score yourself with the PTG exam. Twenty-one historical temperaments also available. Demo disk available. Mark Anderson, RPT: 510-524-0390 (California). Great teaching tool!

NILES BRYANT OFFERS TWO HOME STUDY COURSES: Electronic Organ Servicing: Newly revised. Covers all makes and models — digital, analogue, LCT's, synthesizers, etc. Piano Technology: Tuning, regulating, repairing. Our 87th year! Free booklet; Write or call NILES BRYANT SCHOOL, Dept. G, Box 19700; Sacramento, CA 95819 — (916)454-4748 (24 hrs.)

BILL GARLICK SEMINARS-Upgrade your skills at intensive six day resident seminars at Bill's home. Applications are invited for upcoming seminars in tuning, grand action regulation, historic tunings, harpsichord maintenance. Tuition includes instruction and use of facilities, private bedroom (share baths), breakfast and lunch. Write or call for information. Bill Garlick, RPT, 53 Weeks St., Blue Point, NY 11715; 516-363-7364.

THE RANDY POTTER SCHOOL OF PIANO TECHNOLOGY — Home Study programs for beginning students, associate members studying to upgrade to Registered Piano Technician, and RPT's wanting to continue their education. Tuning, repairing, regulating, voicing, apprentice training, business practices. Top instructors and materials. Call or write for information: RANDY POTTER, RPT; 61592 ORION DRIVE; BEND, OR 97702; 503-382-5411. See our ad on page 3.

THE 1995 NORTH CAROLINA REGIONAL CONFERENCE will be Nov. 2-5 in Durham, NC. This year the instructors include Nick Gravagne, Bill Garlick, Wally Brooks, Laroy Edwards, Scott Jones, Ray Chandler, Don Mannino, Kent Webb, John Hartman, David Stanwood, Webb Phillips, Dr. Al Sanderson, Bob Mair, Gina Carter, Gerry Cousins, Ed Dryburgh and others. For more information call Richard Ruggero 919-787-7123 or send a FAX with your address to 919-571-1531 and you will receive our newsletter.

VIDEOS

INSTRUCTIONAL VIDEO TAPES. Victor A. Benvenuto. Piano tuning, $50.00*; Grand Regulating, $50.00*; Grand Rebuilding, $100.00 (2)*; Key Making, $50.00*; Soundboard Replacement, $29.95*. (*Plus S/H). The Piano Shoppe, Inc., 6825 Germantown Avenue, Philadelphia, PA 19119-2113; Ph. 215-438-7038, Fax, 215-848-7426

PIANO TECHNOLOGY EDUCATIONAL MATERIALS. $49.95 each reel— Vertical Piano Regulation, presented by Doug Neal. Presented by Cliff Geers: Plate & Pinblock Installation Part I, Plate & Pinblock Installation Part II, Wood Repairs, Soundboard Repair, and Grand Hammer Replacement. Add $5 per order for shipping and handling. Questions? Call 712-277-2187. Mail orders to PTEM, 3133 Summit, Sioux City, IA 51104 .

WANTED

WANTED!! DEAD OR ALIVE: "Steinway uprights and grands." Call collect, Ben Knauer, 818-343-7744.

REWARD OF $1000!!! for information leading to the recovery of Bechstein Baby Grand, reddish-brown, antique. Stolen 4/12/95 during transit in Philadelphia, PA. Chris Burrows, 410-366-5790.

PIANOS! PIANOS! PIANOS! !!!Free phone appraisal!!! Buying all types of usable pianos. Cash or bank check on pick up. Won't hesitate on price. Call us first for fast professional service. "Steinway, Mason-Hamlin command specialty prices." Jay-Mart Wholesale, P.O. Box 21148, Cleveland, OH 44121. Call Irv Jacoby collect 216-382-7600

JAY-MART WHOLESALERS — !!!Free phone appraisal!!! Buying all types of usable pianos. Cash or bank check on pick up. Won't hesitate on price. Call us first for fast professional service. "Steinway, Mason-Hamlin command specialty prices." Jay-Mart Wholesale, P.O. Box 21148, Cleveland, OH 44121. Call Irv Jacoby collect 216-382-7600

PIANO ROLLS WANTED—*Artecho (QRS), *Apollo, *Artrio-Angelus, *Farrand/Cecillian/Connorized Organ Rolls; Glenn Kriese, 3780 S. Shimmons Cir., Auburn Hills, MI 48326.

ANTIQUE GRAND PIANOS WANTED: Any restorable condition. Top prices for pre-1850, wood-frame grands in original condition. Ed Swenson; P.O. Box 634; Trumansburg, NY 14886; 607-387-6650; Fax: 607-387-3905.

WANTED: TINY PIANOS such as the Wurlitzer Student Butterfly or other small types. Call collect: Doug Taylor, 607-895-6278. I'll pay shipping!

STEINWAY & MASON HAMLIN WANTED!! "Dead or alive." $$$ Grands, uprights, consoles—any size, cabinet style or quantity. Cash and immediate removal. Finders fee for successful purchases. Call us first!! 800-438-3814 toll free or write to be listed in our worldwide data banks. Piano Wholesalers, 5817 Wickfield Drive, Parma Heights, OH 44130. Call us first!! 800-438-3814.

DISPLAY AD INDEX

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Quantity | 500/$50.00 or 1000/$75.00

PianoDiscussions™

July 1995

News From The World of PianoDisc

*Quiet*Time

Pianos get a "silent partner"

QuietTime is the new "silent partner" for the acoustic piano. It's a partnership that gives the acoustic piano many of the features and benefits of an electric keyboard without sacrificing any of its own.

QuietTime is Music Systems Research's new stand-alone retrofit device that can mute a piano 100 percent and like the PDS 128, QuietTime can be installed on virtually any piano, grand or vertical. It is completely compatible with the PianoDisc system, but can be used independently.

QuietTime has obvious benefits to pianists at every skill level. With QuietTime, the pianist can practice, play or compose on the piano with no sound other than what is heard through the headphones. Anyone else in the room is undisturbed.

A popular option available is the internal tone generator, which can change a piano performance into other sounds or special effects. With the keyboard interface and tone generator connected to any external MIDI device, it's possible to orchestrate, create sheet music, even lay down drum tracks.

Dealers should find QuietTime one of the easiest sales they'll ever make. It will appeal to the beginning piano student (and his parents), to the accomplished performer/composer, and everyone in between.

PianoDisc Installation Training 1995

- July None
- Aug. 8-12
- Sept. 12-16
- Oct. 17-21
- Nov./Dec. 28-2

Continuing Education Series 1995

- August 3-4
- October 12-13

Tuition for the installation and Continuing Education seminars is **free**, but a $50.00 refundable deposit is required for confirmation. The PianoDisc Continuing Education Series seminars are restricted to PianoDisc certified technicians in good standing. For more information about attending a PianoDisc Installation Training seminar or a Continuing Education seminar, call PianoDisc during our office hours (see below).

PianoDisc

4111 North Freeway Blvd.
Sacramento, CA 95834
Phone: (916) 567-9999
Fax: (916) 567-1941

Tech Support: (619) 258-1460
(916) 567-9999

Our telephone lines are open daily (except weekends and holidays) from 8 AM-5 PM Pacific Time.

5-year warranty goes commercial

The outstanding warranty provided with the PianoDisc line of products has been extended to include commercial usage. All PianoDisc pianos and retrofit kits sold to commercial establishments will carry the same 5-year warranty previously reserved for consumer purchasers only.

The warranty covers any defective parts for a period of five years from date of purchase.

"PianoDisc has a warranty second to none in the industry," says Vice President Tom Lagomarsino. "Our warranty no longer makes any reference to the way in which the system will be used. All purchasers will be equally covered."

Now the world's best selling player system, with the most advanced technology, has an outstanding warranty available to everyone.

Summer NAMM here we come!

Be sure to drop by Booth 218 to catch up on the latest and greatest from PianoDisc. We love "Show & Tell" and we've got a thing or two we'd love to share! For hot fun in the summertime, Nashville and Summer NAMM can't be beat! See you there!

Liner Notes

McPartland joins Artist Series roster

What can you say about the talent and style of the incomparable Baldwin Artist, Marian McPartland? In the words of Leonard Feather, "She is an exceptionally lyrical ballad performer, enriching and expanding the harmonic and melodic essence of every theme." *The New Yorker* critic Whitney Balliet wrote that she "moved beyond adroit adulation into her own special realm. It is ... an emotional, romantic and highly inventive one."

Numbered among her friends and fans are the biggest and brightest stars of jazz, most of whom have been on her long running National Public Radio program, *Piano Jazz*. The show features guests from every niche of jazz, and the format is a comfortable one of conversation interspersed with performances by the guest and Ms. McPartland. No matter what the genre, she carriers her own with all of them.

Noted stride pianist, and PianoDisc artist, Butch Thompson recalled his appearance on the show. "She asked me what I'd like to talk about and we came up with a few things. Once we got started, though, we just talked, like old friends, and never did get into what we'd planned. She has a talent for making the guest feel comfortable and important. When we played our duets, she played with me. It was really easy and extremely enjoyable."

It is with no small amount of pride that we welcome Marian McPartland to the PianoDisc Artist Series. Due to record this month, Ms. McPartland will bring her soulful stylings to PianoDisc audiences. And when we say soulful, we mean it in the strictest sense of the word: everything she plays is infused with feeling and emotion. Even a simple melody becomes something extraordinary in her hands and every song is a glimpse into the very special soul of Marian McPartland.

YAMAHA®

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THE 38th INTERNATIONAL PTG CONVENTION AND TECHNICAL INSTITUTE 1995 - Albuquerque, New Mexico

WE LOOK FORWARD TO SEEING YOU AT

Wednesday, July 19

Exhibit Hall — *See our new acoustic pianos, new Disklavier pianos and new Silent Series Pianos*

Thursday, July 20

Exhibit Hall — *See our new acoustic pianos, new Disklavier pianos and new Silent Series Pianos*
Secrets of Performance Piano Preparation ..... Class Periods 3 & 4 — San Miguel room

Friday, July 21

Exhibit Hall — *See our new acoustic pianos, new Disklavier pianos and new Silent Series Pianos*

As our way of saying THANK YOU FOR A GREAT YEAR,
we'd like to WELCOME *you to our*
YAMAHA RECEPTION *featuring the famous A440 band (bring your horn!)* 9:00PM

Saturday, July 22

Exhibit Hall — *See our new acoustic pianos, new Disklavier pianos and new Silent Series Pianos*
Disklavier Master Class .....Class Period 2 — San Miguel room
Secrets of Performance Piano Preparation ..... Class Periods 3 & 4 — San Miguel room

Sunday, July 23

Exhibit Hall — *See our new acoustic pianos, new Disklavier pianos and new Silent Series Pianos*

Tech Gazette will resume in July

SEE YOU IN Albuquerque