Piano Technicians
Journal
February 1986

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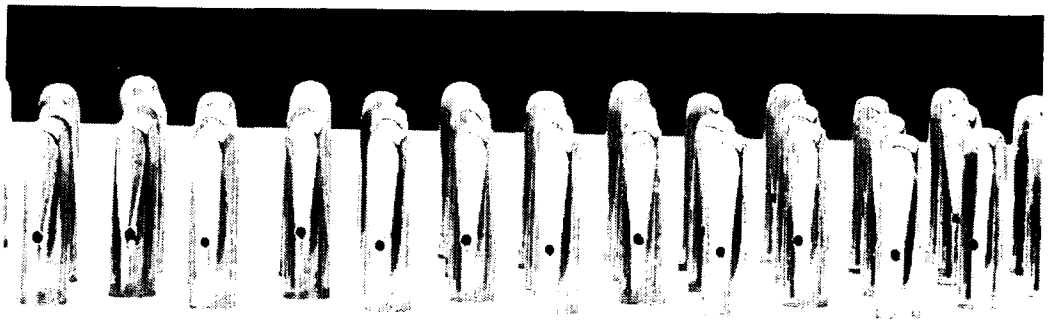

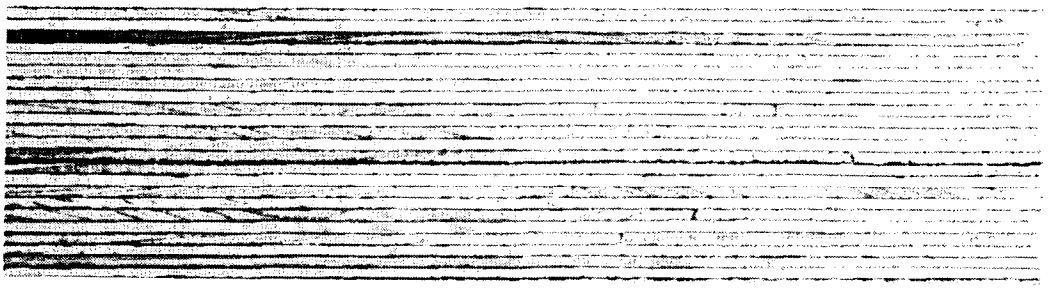

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Piano Technicians Journal **February 1986**

Official Publication Of The Piano Technicians Guild, Inc.

Volume 29 Number 2

IN THIS ISSUE . . .

PLUS . . .

ABOUT THE COVER

A pianoforte constructed by Bartolomeo Cristofori. From the Metropolitan Museum of Art, The Crosby Brown Collection of Musical Instruments, 1889. (89.4.1219)

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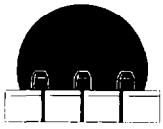

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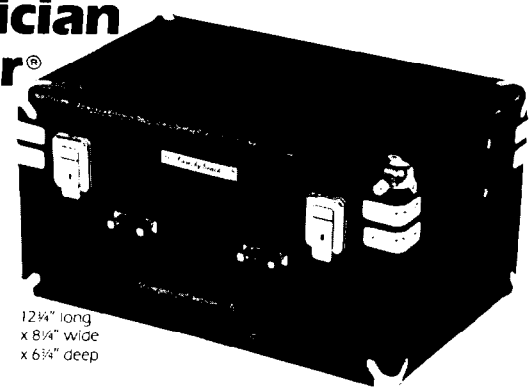

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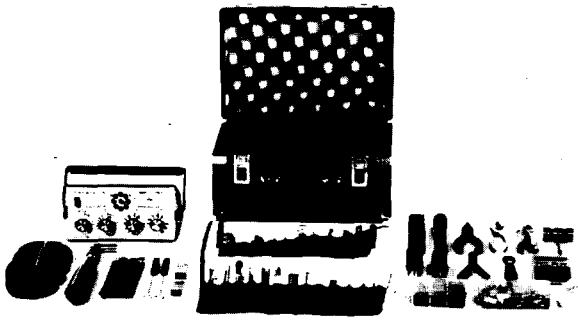

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The President's Perspective

Charles P. Huether
President

Anatomy Of A Meeting

The necessities of production deadlines prevent me from including in this column a report on the board meeting to be held Jan. 11-12 in Kansas City, weather permitting. Writing this in advance of that meeting, and in the midst of the turbulent and unusual weather we are experiencing all over the country makes positive predictions of time and place unrealistic. But piano technicians are hardy people and we manage to travel and work under some extraordinary conditions. Kansas City, January 11-12, is pretty much of a certainty.

One important aspect of our meeting will be a review of organizational management. We initiated a new practice last July, and a board committee will meet with our management every three months. We met in October and will meet for the second time January 10, one day before the regular board meeting. As this practice and process develops, it will result in a better and smoother operation.

Along these lines, problems and administrative details which involve essential but behind-the-scenes operations may not be obvious to the general membership. We on the board and in management try to recognize and correct such situations. Each individual complaint and/or problem must be addressed in two ways. First as the concern of the member or chapter affected, and secondly as a possible indication of some aspect of our operation which can be improved or corrected for better efficiency and service.

Our board meeting will be addressing a variety of issues. Among them will be a review of committee reports and suggestions, refinements for our testing procedures, a review of insurance programs and possible improvements, and most especially, a review of the work of the special committee on membership.

An essential part of this and every meeting will be the input of the Regional Vice Presidents regarding special problems and situations unique to their respective regions. Our RVPs have always used our meetings for exchanging experience and ideas with the other board members. This exchange usually results in new insights and solutions to what seemed to be insurmountable problems. Everyone, including the president, vice president, secretary-treasurer, as well as the RVPs, comes away from the meeting with new ideas concerning their particular work and responsibilities. We discuss, even argue, but essentially we share for the benefit of the Piano Technicians Guild.

As I write this, I am preparing for the meeting. My one hope is that there will be time enough to get everything sorted out in advance. I know, however, that there will be some surprises as we sit down to work, as there always are. Issues or problems no one was anticipating are bound to arise and add to the agenda and work load. Anticipating those situations is also a part of preparation.

Through its board of directors, the Piano Technicians Guild continues to reexamine its current positions and management. Believe me when I say that we are never complacent. Being used to constant review of our own work as piano technicians, we apply the same attitude towards our organizational operation and our participation in that operation. Nothing is ever beyond improvement. Just as we continue to strive for the "perfect" tuning or action regulation, knowing deep down that it can never exist, so too do we strive to make sure our membership gets the best in organizational structure and administration. That is our responsibility as your elected board of directors. That is what every board member I have ever sat and worked with has placed uppermost on his list of priorities and responsibilities. The viability and success of our organization tells the story of how well we have been able to approach those impossible goals. That the dream may be impossi-

Continued on page 10

From The Executive Director

Barbara Parks
Executive Director

I Understand What I Think You Said, But . . .

It's a classic routine from countless late-night movies: the convicts are in the prison cafeteria eating swill and moldy toast. A guy at one end of the table whispers the evening's escape plans to the guy next to him, who passes it along to the next guy, and so on. By the time the message reaches the other end of the table, it has changed from "We go over the wall at nine" to "Luigi the Lip wants his girlfriend to bake him a cake."

When it happens to Abbot and Costello, it's funny, but when it happens in real life, it can be a tragedy. You may have had a similar experience after a conversation with a client, a vendor or an employee — maybe even your spouse. Both of you think you have reached an understanding as to what is to be done, when it will be done, what it will cost and who will do it. All is harmonious until the job is done, the bill comes, the shipment is delivered, or the deadline is reached.

Then the earlier conversation turns out to have been between two other people, one of whom was speaking Serbo-Croatian. What the other person heard was certainly not what you said, and vice versa. The courts are full of similar cases. Empires have fallen for less.

Think of it this way: when you want to communicate with someone, you have to put your thoughts into a sort of code — language. When you speak or write your message, you are transmitting in a code which, theoretically, the other person can decipher. But there are problems which interfere with understanding.

The way you encode your message is affected by your situation and your background. If you are in a hurry, you may not explain yourself well. If your mind is on something else, you may confuse two messages. If your background is technical, you may speak in a jargon that the other person will not understand.

The environment may have an effect, too. If you're in a crowded restaurant or in a shop where power tools are running, the noise may have an effect like static in a radio transmission. Everything that goes on around you can decrease the effectiveness of your transmission.

Problems arise when the message is decoded, too. The recipient's background may affect his understanding — the same word may have different meanings in different professions. He may be in a hurry, or preoccupied. His priorities may be completely different from yours.

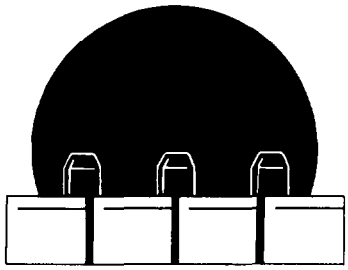
This process of coding and decoding goes on throughout every conversation. When you think about it in these terms, it's amazing that people understand each other as well as we do. But there are some things that can improve the communications process.

Start with an open mind. Don't assume immediately that you know what the other person is talking about and what he or she will say.

Repeat what has been said. Tell the other person what you think he or she said, in your own words. Don't be afraid to ask questions.

State your own thoughts clearly. It's not an insult to talk to someone in words of one syllable, especially if he or she doesn't share your technical expertise. And take the time to make sure you have been understood.

If it's really important, write it down and keep a copy for yourself. After weeks or even months have passed, it's tough to remember what was said in a five-minute conversation.



Realize Your POTENTIAL

Ben McKlveen
1986 Institute Director

Live A Little, Learn A Lot — In Las Vegas!

In July of this year the Piano Technicians Guild will hold its annual convention at Caesars Palace in Las Vegas, NV. I had never been to Las Vegas until last November, when I spent a couple of days looking over the hotel for this year's Institute. It was an experience! I expected to find a little town of a few thousand or so and a main street of casinos. Actually, the city is much larger and more spread-out than I would have imagined. It is a very colorful and diversified city, and a great place for a convention. In the midst of all the splendor of "the strip" is our hotel, Caesars Palace. Beautiful rooms, beautiful restaurants, and beautiful recreational facilities abound.

This year's Institute will be housed in the convention facilities at Caesars Palace. The classrooms are all on one floor next to the lobby. Here we will offer you classes on all phases of piano service, taught by some of the best instructors in the world. These people are experts at what they do and they are eager to pass their knowledge on to you. Some of the instructors are factory personnel. They bring you the "why" and the "how" of pianos from the factory point of view. Others are field technicians with a wealth of experience and knowledge about solving problems in the field. Some are experts of a very special sort. They have knowledge and information that will broaden your viewpoint, teach you new techniques or help you solve particular problems.

What kinds of classes do we have? We have tuning classes, both aural and electronic, basic and advanced. There will be comparison classes between aural and electronic techniques. There will be instruction in regulation and repair of grands and vertical pianos, player classes, business classes, tool classes and a whole series of classes about rebuilding of pianos. We have some special classes about which I will tell you in future articles.

"Wonderful!" you say, "but why should I consider going to Las Vegas?"

One of the most important reasons you should attend this Institute is summed up in two words — continuing education. The last decade has seen so many changes in the piano business. You need the stimulation of new ideas, new technology, and new information to keep your career moving forward. If you are just beginning, the Institute classes will help you to move along to another level of competence.

You can make new friends. The halls and exhibits are crowded with fine technicians who are picking each others' brains about piano service. Not all the experts are in the classrooms. Your attendance will permit you to be part of that exchange process.

Speaking of friends, the great faculty of this year's institute is composed of people who are my friends, all of them with special knowledge and skills. These friendships were formed over a number of years at meetings such as this year's convention. They are invaluable to me! I can call on these people for help any time I have a piano problem I can't solve. These people can be your friends, too, but you will have to come to Las Vegas and meet them in order to get the benefit of their knowledge and friendship.

The theme of the 1986 convention is "Realize Your Potential." In order to do this, you must resolve to attend this year's Institute, where you will share time with the best piano people in the world and learn from them. You will carry home a great deal of useful information. If you practice what you have learned, you will then begin to "realize your potential."

So *live a little and learn a lot in Las Vegas.* In the coming issues of the *Journal,* I will tell you more of the 1986 Institute. In the meanwhile, start your planning for this event. A great

Continued on page 10

Our Beginnings

Richard B. Quint
Waukegan, IL, Chapter

Searching For Our History

We as piano technicians are what we are to a large extent because of those who went before us sharing their knowledge and experience. It all began, some say, when Wm. Braid White organized the Helmholtz Society in 1904. From what I have learned to date, it seems the American Guild of Piano Tuners stemmed from that group and later became the National Association of Piano Tuners in about 1914.

There is a great deal of history leading up to what we have today in the Piano Technicians Guild. As most of us know, the American Society of Piano Technicians (ASPT) formed in Chicago in 1940 merged with NAPT in 1958 to become the Guild. Another interesting thing is that Wm. Braid White seems to have been the prime mover in all of these organizations, but so far I have not turned up documentation to support this.

At the last convention in Kansas City, it was decided to compile a history of piano technicians and their organizations as a Guild project. John Travis and I were named to get it started, but were encouraged to enlist all the help we could get. Believe me, I've been bugging a lot of people. So far, we have located some materials and have some notes, but we know there must be a lot more in attics and in the memories of some of the "old- timers." It will take some doing to get all the facts and stories together and we solicit contributions from anyone interested. It would be helpful if all the past presidents would send me their autobiographies and pictures, etc. Other items of interest like the portable piano taken on the train by the group going to Detroit for a convention in the 40s would be helpful, too. Does anyone out there remember Al Utterburg and that piano?

I have been studying some copies of old magazines from the 40s and 50s sent me by Ben McKlveen and found a lot of history in those pages. Some of the articles by some of these men make one feel very humble. In the May 1947 issue of *The Technician,* Jessie M. Kingsbury had an article entitled "Help the Beginners," that was pretty indicative of attitudes of that day. Jessie apprenticed at Smith & Barnes factory in the action department when he was just 15 years old. In those days, apprentices were not paid, they had to learn first. Some two years later, he entered the action department of the Waltham factory but his keen interest in tuning brought him back to Smith & Barnes to learn tuning from the bottom up.

About 1914, he gave up factory work to enter the service department of the Heller Piano Co. He became an expert in player and reproducing pianos, and went on to round out his experience in sales and business practices before going into private practice in 1924. With his enterprise and honesty, he became one of the most prosperous piano men in the midwest, as well as president of both the Wisconsin and national ASPT organizations. We all know his son Ralph and grandson Richard from the Piano Technicians Guild — those Kingsburys have some tradition!

There were great men in all these organizations who contributed so much of their time and talent with little or no remuneration. In fact, it cost most of them. It wasn't until recent years that instructors at convention received any compensation for travel, etc. The same was true for officers.

And the Auxiliary, what a history they have! Some of the stories in these magazines indicate they were a very active group that may well have been the glue holding things together. Certainly without their support and encouragement it wouldn't have been the same. There were a few lady tuners back then, too. The *Tuners Journal* of November 1943 lists Florence Shoop as the first lady registered tuner of NAPT. Hannah Grover was the first lady tuner in ASPT, joining in 1943. Mrs. Dowling joined in

Continued on page 10

The International Scene

Fred Odenheimer
Chairman, International Relations Committee

Appeals From Overseas

Of late we have had a number of letters from various budding technicians in foreign countries who would like to come to the U.S.A. for a limited time to learn more about our methods of tuning and technology or to prepare themselves for our Guild craftsman exam.

"I am a first-year student at the Welsh School of Musical Instrument Making and Repair," writes R.C. Mantle of Abertridwr, "and I hope to qualify in two years as a piano technician (City and Guilds, London Institute, plus my own colleges diploma). I am greatly interested in gaining experience with American pianos, including player pianos, which I understand are very popular in your country. The only way to gain experience, of course, is to work in your country for a length of time . . . I would like very much to work in a piano workshop or even for a manufacturer during my 1986 summer vacation."

Marcel Speckamp of Karlsruhe, West Germany, writes, "I am sure you are a bit surprised to receive this letter. I got your address from Johannes Ruoss. He took part at the convention this year in Kansas City. I absolved my apprenticeship in a workshop in Karlsruhe. When we met each other sometimes in the trade college, Johnny told me about his wonderful time in the U.S. Now my question: is it possible to work for a certain time in your workshop next year?" (Unfortunately, I am retired and the workshop is closed down — F.O.) "Mostly, I repaired pianos, but this winter I want to improve my knowedge in industry for some weeks at Grotrian Steinweg . . . I would very much like to see how people work and live in the U.S."

And Mr. (or Ms.?) James of West Malaysia writes, "I would like to visit your country as well to prepare for the RTT exam. But before that, I would like to inquire if there is any senior technician who will accept me as a student, and I am ready for the exam. So, would you guide me as I am also willing to work very hard. This is because in my financial situation I can't afford to enroll in a private school. I only had saved enough money for the flight. I hope that there is someone or any senior technicians that would take me in."

I am sure there must be readers who are able to help and gain the gratitude of the inquirers, and have a wonderful experience at the same time in relations with people from other countries across the globe.

If you can take somebody, please write to Barbara Parks, executive director of the Guild, at 9140 Ward Parkway, Kansas City, MO 64114, or Fred Odenheimer, international relations committee chairman, 15358 Wyandotte St., Van Nuys, CA 91406. Please do it soon, because these technicians and future technicians wait for an answer.

Beginnings . . .

1947 and Mrs. Hadfield in 1948.

In early years chapters were know as "divisions." The February 1947 issue of *The Technician*lists 21 divisions of ASPT, most of which were located in major cities from coast to coast. For Larry Crabb, back in 1947 John Tapper was the leader of "Barber-Shop." Maybe some of your singers remember him. Incidentally, he was head of the "Boston Tuners Association" before it became a division of ASPT. There was also another group in New York prior to the American Guild, I understand.

Through the years, there have been controversies about a variety of issues. Back in the 40s, some were saying there was a shortage of tuners, while others like Al Utterburg said he didn't see anyone standing in line waiting to have their piano tuned. He said the so-called shortage was the result of dealers not being willing to pay what the tuner deserved and so the dealers were hard-pressed to find tuners who would tune for peanuts.

And when the drop-action spinets came out, you could hear the screams from one end of the country to the other. Yet some felt they had their place and we just had to live with them. A few ads appeared in the journals for drop action removing aids. I don't know about the rest of you, but I still dread the drop action jobs.

Pricing has been a topic since the very beginning. Some tuners were undercutting their competition, and there was always the unskilled. There were some pet names for these guys, too. But through it all, there was organizational spirit to improve skills of the membership and enhance the image of the piano technician. Examination for registered technician was pretty demanding in the early years but seemed to lag 20 years or so ago. One fellow told me all you needed was a business card, a tuning fork and lever when he joined in the late 50s.

You could probably spend years studying all the available material on piano tuners and their organizations. But if we can just compile the highlights and amusing stories, etc., I think it will be a very interesting and worthwhile thing to have. Send me a note to let me know what you think. My address is 916 North Ave., Waukegan, IL 60085, or you can call me at (312) 623-4528.

Las Vegas . . .

hotel in an interesting city combined with a Piano Technicians Guild Convention and Institute adds up to a marvelous opportunity to combine a wonderful vacation with a fabulous learning experience. It is tax-deductible and it is at Caesars Palace July 21-25, 1986.

Meeting . . .

ble is no reason for not striving to achieve it.

Preliminary reports and support material for our agenda indicate successful and positive results for these meetings. The Piano Technicians Guild can face 1986 with optimism. Let this optimism carry over into your work and your business. You can better share this upbeat feeling by being an active member of the Piano Technicians Guild. Attend chapter meetings, participate in chapter activities, read the *Journal*, go to a seminar, attend the convention. Make this year the best ever.

THE
TECHNICAL
FORUM

Piano Hardware And Specific Squeaks

Jack Krefting
Technical Editor

Piano Hardware

This discussion is to address several questions we have received regarding replating, buffing and reassembly, mostly from technicians who are reassembling an unfamiliar brand of piano for the first time. Although it would seem obvious that most of these problems would be solved by simply keeping the parts in order for reassembly, there are times when that isn't possible, such as in basket cases or when the hardware is sent out for replating. In such instances, any trick that will help get the hardware back where it belongs is good to know.

If the hardware is solid brass, all the options are available to the customer. It can be buffed bright or satin, or it can be plated. If it is steel, however, it will have to be replated unless the existing plating is still adhering and simply needs cleaning and polishing. Carry a small magnet and check several pieces to be sure, as sometimes steel and brass hardware are used on the same piano, and if they are plated, it is difficult to tell which is which. If the magnet sticks to any of the hardware, it isn't solid brass.

Assuming the hardware will not have to be sent out of the shop for plating, here are two ways to keep it in order.

1. Using a piece of corrugated cardboard, such as the bottom of a box as shown in *Figure 1*, it is easy to stick the screws into holes that have been punched with an awl or icepick. Mark an appropriate description on the cardboard, such as "continuous hinge" or whatever, and as each screw is removed for buffing, it can be returned to the same hole for ease of assembly.

2. Use pint-size zip-loc transparent sandwich bags, one for each category of screws and other hardware, and slip a piece of paper with appropriate markings into the bag for easy identification. Even simpler is the procedure of marking right on the bag with a magic marker, although this precludes reusing the bag on another piano later.

"

Carry a small magnet and check several pieces to be sure, as sometimes steel and brass hardware are used on the same piano, and if they are plated, it is difficult to tell which is which. If the magnet sticks to any of the hardware, it isn't solid brass.

"

If the parts are dirty and/or corroded, we have found it quicker to pre-clean them with some solvent such as lacquer thinner. This gets rid of the grime easily and keeps the buffing wheel from loading up as quickly. If a light abrasive is desired in this pre-cleaning, we suggest fine Scotch-Brite. Rubber gloves will keep the solvent off the hands, which can be vital or desirable depending on the solvent selected.

Cloth wheels, approximately one-quarter inch in thickness, are readily available in hardware stores. We suggest the six-inch diameter, with several cloth wheels mounted together to make a composite wheel at least an inch wide — the more powerful the motor, the wider the wheel can be — and use a mounting arbor in a 1725 rpm motor of at least 3/4 hp. If different grades of rouge will be used, have a separate wheel for each so they will not become mixed together on any one wheel. Mount the motor so the part of the wheel nearest the operator is moving downward, as this will prevent any material flying off the wheel from hitting the face. Naturally, it is still mandatory that a face shield, or at least safety goggles, be worn by the operator and anyone else in the vicinity. A small hinge screw,

held against the wheel with a pair of pliers, can suddenly fly away with enough force to cause serious injury if the above precautions are not taken.

Jewelers' rouge is available in brick form in various colors to indicate the grade of the abrasive. White is the finest, yellow is next, and so on until we reach the black, which is coarsest. We recommend a finer grade such as yellow or white for plated parts, as the finer grit removes less material; for solid brass, a somewhat coarser grade is preferred because it cuts faster and still produces a mirror polish, and we aren't concerned about cutting through the plating.

Hold the rouge brick against the spinning wheel for a moment or two, and then hold the part against it until it is brightly polished. Small parts can be held with pliers or visegrips, with screw slots parallel to the wheel's rotation so they will be cleaned out while the head is being polished. If the part is of brass or has a brass plating, do not touch it with bare hands after it has been polished, as this will cause tarnishing. Instead, stick the part back into the cardboard with pliers and, when all the parts are buffed, spray them with clear lacquer. When the lacquer is dry, they can be handled normally and will stay bright. For a satin finish, use a fine wire wheel instead of the cloth wheel.

Steinway continuous hinges present a special set of problems because they are really small sections of hinge, custom-fitted in pairs and assembled on a common brass rod. The problem is that not only are the hinge sections not interchangeable, but even the hinge pairs cannot be interchanged to different positions on the rod without plugging and redrilling all of the hinge screw holes! Failure to replace them in the correct order on the rod will result in unsightly variances in the gaps between the hinge sections. If the hardware is brass and will be kept that way, it is of course possible to simply leave the hinge assembled, buff it that way, and replace it; but if it is sent out for replating, it will have to be disassembled because otherwise the plating won't stick to the hinge. The best way we know to solve that problem is to scratch a code mark on the back of each hinge section before removing it from the rod, as shown in *Figure 2*. Then identify the rod with the serial number of the piano, because even the rods aren't necessarily interchangeable. Steinway not only used different lengths for different models, but even different rod

Figure 1

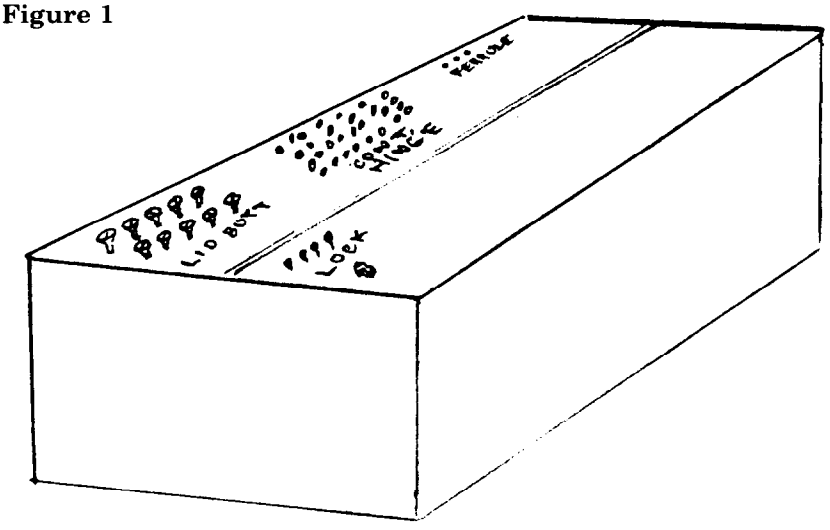
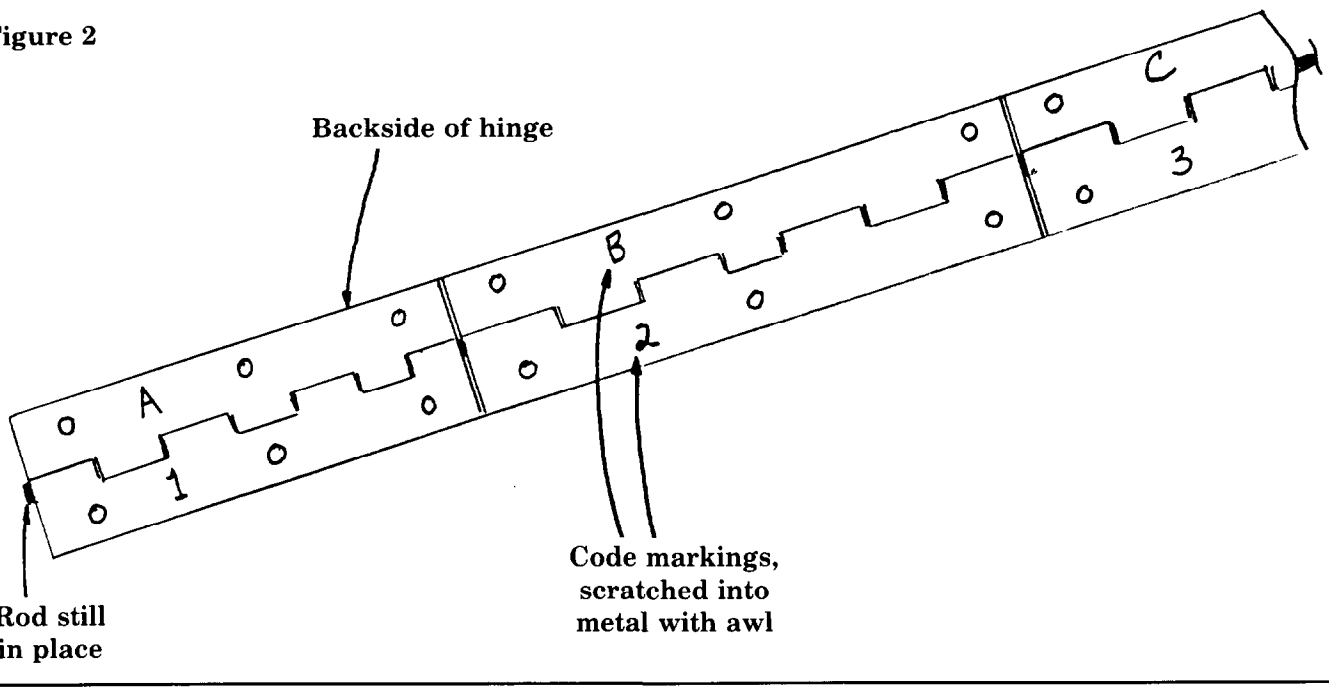


Figure 2



diameters on occasion.

Here is a suggestion for reassembling a Steinway hinge which has worked well for us:

1. Lay out the replated hinge sections on a bench, matching them by pairs and then putting the pairs in order. If the pairs will not go back together, it may be necessary to remove a slight amount of the plating from the edges of the hinge tongues with a fine file. These edges will not be seen when the hinge is assembled anyway.

2. Clean the brass hinge rod with fine steel wool and solvent, taking care not to bend it, and file off any burr that may be on either end of the rod. Then apply a very thin coat of petroleum jelly to the rod, partly to lubricate the hinge but mostly to make it easier to reassemble.

3. Select the hinge pair that is nearest the middle, and slip it on the rod first; then slide all other pairs on from the nearest end so they will all be in order. Wipe away any excess petroleum jelly that may have squeezed out.

4. Put the hinge in position on the rear lid, being sure that the short hinge pair is at the bass end, and space the hinge pairs to line up with the screw holes in the lid. If everything was done correctly, the gaps between pairs will now be even and the front lid can be attached without problems.

The experienced rebuilder knows at a glance which screws go where, at least on familiar makes and models, but for the benefit of those less experienced, we present a few hints on getting things back together after the plater has dumped all the small parts and screws into a coffee can.

Take notes during teardown, measuring the length and diameter and noting the head type. Since screws are measured from the tip to the widest part of the head, it follows that a round-head screw will actually be longer than an oval-head screw of the same length, which will in turn be longer than the equivalent flathead screw.

If in doubt about the screw length for a given hole, probe the hole with a piece of wire to determine its depth and match the screw to the hole in that manner. But before doing any guessing, lay out all the screws that can be identified. By process of elimination, it should be obvious where the rest of them must go. Always be aware of the thickness of case parts, avoiding running the point of a screw into the face veneer on the other side.

Finally, we should note that it is sometimes less expensive to buy new screws than to have the old ones replated, especially in the smaller sizes. Most platers don't want to do piano parts because they require custom handling and therefore cannot be entrusted to production personnel, so the price for the work becomes inflated to cover its nuisance value to the plater. One Cincinnati plater, for example, recently quoted a price of $1 per screw and $10 per pedal — we didn't pursue it further so it's anyone's guess what they would have charged to replate the entire set — which makes replacement a more economical choice if the equivalent new parts are available. If cost is no object, however, custom replating tends to be better-looking because each part is individually polished and therefore the finish of all parts will match perfectly.

Specific Squeaks

Q: *I do not recall reading anything about how best to deal with squeaks emanating from parts of the piano that have metal and bushing cloth rubbing against one another. This problem often shows up even in new pianos within a year or so.*

For example, squeaks in keys at center pin or front rail pin. Is this best remedied by polishing the metal? Would it be permissible to add a very small amount of pure lanolin to the cloth at the point of friction?

Another one I had recently was a squeak in a grand hammer flange. By removing the hammer and holding its shank and just moving the flange an annoying squeak could be heard. I concluded it was the center pin rotating against the bushing cloth as the pin was snug in the birdseye.

Other areas you might comment on: spring rail spring against hammer butt, damper spring against damper lever, damper lift rods against damper lever cloth which the wippen damper spoon pushes against.

Perhaps there is more than one way to tackle problem squeaks in these areas, some quick, some laborious. I will appreciate your comments.

— Dennis Johnston, RTT
Oromocto, NB, Canada

A: This is a controversial area, agreement not having been reached even among manufacturers, let alone technicians. However, in general our position continues to be that no lubrication should be needed or used in action centers. If the center is clean and the clearances proper, German silver pins will not squeak in wool cloth bushings; therefore, if a squeak exists, something must be wrong with the center. In our view, the cure is to attack the cause rather than the symptom, so lubrication is not indicated. While lubrication will probably stop the squeak temporarily, it will almost certainly not be a long-term solution, and it does one's reputation no good to have to keep coming back to fix the same problem again and again.

In the specific case in question, where the pin is tight in the birdseye and yet the center squeaks, the most likely cause is that there is no end play, resulting in the birdseye rubbing hard against both sides of the shank fork at the same time. The solution is to unpin, file the inner faces of the shank fork — never the birdseye — and repin with a new pin of a diameter that will allow five to seven swings, depending on the relative humidity at the time. The other possibilities, including a bent pin or a contaminated center, would also require repinning at the very least, so unpinning will be necessary in any case. That takes more time than squirting something on the center, but will save time in the long term because callbacks won't be necessary.

A number of new and nearly new pianos have shown a tendency to squeak at the key bushings, a problem that seems to have worsened considerably in the

past two or three years. It is our feeling that this may be caused by excessive glue in the bushing cloth, although this diagnosis has not been proven conclusively. We do know that the pins are not at fault, however, because we have heard of no continuing squeaking problems after the keys have been rebushed. Once again, attempts to lubricate the pins — or the bushings, for that matter — have not been successful except temporarily, according to reports we have heard.

Burnished graphite seems to work best in spring slots or in any metal-to-wood friction point, for that matter, in that it far outlasts the teflon-type spray lubricants that are sometimes used, which are otherwise fine for the purpose.

Metal-to-cloth friction points represent more of a problem because dry graphite doesn't adhere very well to either surface, and we want to avoid using petroleum-based lubricants above keybed level for a whole variety of reasons. Cloth-lined spring slots shouldn't require lubrication, provided the springs are plated and the right amount of glue was used to attach the cloth to the wood. Perhaps because of the small amount of movement of the spring in its slot, or possibly because of the relatively light pressure involved, dry graphite works fairly well in this application.

"Metal-to-cloth friction points represent more of a problem because dry graphite doesn't adhere very well to either surface, and we want to avoid using petroleum-based lubricants above keybed level for a whole variety of reasons."

However, the vertical damper lift rod is another story. Here we have a lot of pressure on the friction point and, worse yet, a lot more sliding friction because the arc of the rod is so dissimilar to that of the damper levers. To make matters still worse, most lift rods are made of steel with a microscopic layer of copper plating that wears off immediately, allowing the friction points on the rod to rust in damp weather. The rusty steel slides on 67 or more pieces of bushing cloth, making noise all the while. The best solution would probably involve having the rods stripped and replated with something thick, hard and smooth, like nickel-chromium. As a stopgap measure, we suggest (reluctantly, because it isn't really a good idea but we can't think of anything good that's easy and quick) cleaning the rust off and applying Emralon, SlipSpray or something similar.

Below the keybed, various concoctions based on paraffin or petroleum jelly, with the addition of graphite, talcum powder, lanolin and/or mutton tallow have been used with a fair degree of success by many technicians. If such heavy lubrication proves the only method of eliminating squeaks in the trapwork, by all means do what is necessary, but in the knowledge that petroleum-based lubricants can get dirty and gummy, and that paraffin-based concoctions can cause other noises, especially if used in a wood-to-wood or metal-to-wood application.

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Cristofori Pianos That Survived

Jack Greenfield
Chicago Chapter

It took many years before Bartolomeo Cristofori received general recognition in Italy for his invention of the piano. There is no record of any significant mention in Italy between Maffei's article in 1711 and an essay on music in a collection of writings by an Italian author, Count G. R. Carli, published in Milan, 1784-7. In discussing the origin of the piano from the harpsichord, Carli wrote, "the clavicembalo — an instrument always progressing towards perfection, and much improved by Bartolomeo Cristofori, a Paduan, who added hammers to the mechanism; of which *great invention* we are so forgetful that we have even believed it a new thing, bringing it here from Germany and England."

Carli made an error, however, in stating 1718 as the year of invention. This caused some confusion over Cristofori's priority of invention among those who did not know that Maffei described Cristofori pianos he had seen in 1709. The eventual disappearance of all but three indicates Carli's essay had no influence in regard to the preservation of more Cristofori pianos probably still in existence then, less than 60 years after Cristofori's death.

Around the middle of the 19th century, interest in the piano finally spread from other countries back into Italy. There was sufficient demand now for the establishment of several factories. The success of C. Roseler, who had come from Berlin to Turin in 1850 attracted other builders and Turin became the center of Italian piano production. A survey by a commission of the new Italian government after complete unification of the country in 1870

Photograph of Bartolomeo Cristofori 1720 piano taken in 1911 before restoration of finish, keytops and other sections. (The Metropolitan Museum of Art, The Crosby Brown Collection of Musical Instruments, 1889. 89.4.1219)

reported that a total of over 800 pianos were manufactured annually in Turin, most sold domestically, the remainder exported to South America. By 1900, 15 plants in Turin and a few elsewhere manufactured annually a total of 4,000 pianos, harmoniums and church organs.

With growth of the industry came more interest in the origin of the piano there in Italy. Maffei's 1711 article on Cristofori and his pianos was republished in two books, *Cenni Storici dilla viat del Serenissimo Ferdinando dei Medici* (Florence, 1874) by Leto Puliti, and *Il pianoforte* (Florence, 1876) by Cesare Ponsicchi. also in 1876, a plaque honoring Bartolomeo Cristofori, "Cembalaro Da Padova" for invention of "Il Clavicembalo Col Piano E Forte" was placed in the Church of Santa Croce, a prominent 13th-century church which also contains the tombs of Michelangelo, Galileo and Machiavelli, and a plaque honoring Dante. The plaque for Cristofori showed the year of Maffei's article as the year of invention, proven to have been earlier in documents discovered later.

Two Cristofori Pianos Survive In Florence

Puliti's book contained drawings and described a grand piano made by Cristofori dated 1720 that was owned by the Martelli family of Florence. The book also included details in bills for work done by Cristofori for Prince Ferdinando, bills found in the collection of Medici files. The second author, Ponsicchi, also saw the piano and worked on its restoration as shown by the inscription written in ink on the left side of the hammer rail "Restauroto l'Anno 1875 / de Cesare Ponsicchi / Firenze." Later examinations of the piano have revealed that the instrument had had a number of other alterations even before Ponsicchi worked on it.

A second Cristofori piano was also known to be in existence in Florence. This instrument, dated 1726 and with no evident alterations, was part of a collection of musical instruments owned by Alessandro Kraus of Florence. Kraus's Cristofori piano was sent from Florence to Paris for display at the Paris Exhibition in 1878 where contemporary pianos were being shown in the Trade section. Shortly thereafter, the 1726 Cristofori piano was turned over to the collection of Wilhelm Heyer in Cologne. In 1927, most of the Heyer collection, including the 1726 Cristofori piano, was transferred to the University collection in Leipzig, the present location of the piano. Nothing has been published concerning the history of the 1726 Cristofori piano prior to its appearance in the Kraus collection in the 1870s.

"When the piano was obtained for the Metropolitan Museum in 1895, the owner, Diego Martelli, stated that his grandfather, Dr. Fabio Mocenni, purchased the piano in 1819 at a public sale that took place at the Grand Ducal Palace in Siena . . . Dr. Mocenni . . . obtained the piano from a piano tuner in exchange for some wine."

Counterfeit Instruments

The demand for Cristofori instruments after his delayed fame in Italy in the last decades of the 19th century gave some unethical antique dealers an opportunity to profit by offering counterfeit, altered or relabeled instruments of less value. Before locating the genuine Cristofori piano owned by the Martelli family, Mrs. Thompson had been offered a false instrument by a dealer named Francolini, a source of other keyboard stringed instruments of questioned authenticiy.

History Of The 1720 Cristofori Piano

More information has become available on the story of the 1720 Cristofori piano. Its previous and subsequent history is given by Stewart Pollens in his paper, "The Pianos of Bartolomeo Cristofori," (*Journal of the American Musical Instrument Society,* Volume X, 1984, pages 32-68). Pollens is a member of the staff of the department of musical instruments, Metropolitan Museum of Art, New York.

When the piano was obtained for the Metropolitan Museum in 1895, the owner, Diego Martelli, stated that his grandfather, Dr. Fabio Mocenni, purchased the piano in 1819 at a public sale that took place at the Grand Ducal Palace in Siena. According to other information, probably passed on by Diego's mother, Ernesta Mocenni Martelli, Dr. Mocenni, her father, had obtained the piano from a piano tuner in exchange for some wine.

The Metropolitan Museum received the 1720 Cristofori piano as a gift from Mary Crosby Brown. Mrs. Brown had given her original collection of approximately 280 instruments to the Museum in 1889. She continued to collect and donate instruments to the Museum until 1904. Around 1894, she asked her cousin, Mrs. Launt Thompson, who was living in Florence, to look for an authentic Cristofori piano which she could purchase. In June, 1895, Mrs. Thompson found the Martelli family and made arrangements for the purchase of the Cristofori piano for Mrs. Brown's donation to the Museum.

Descriptions Of The 1720 and 1726 Pianos Published

Alfred Hipkins, whose research helped confirm the fact that Cristo-

fori was the true inventor of the piano described the actions and gave other details of the 1720 and 1726 piano in his book *A Description and History of the Pianoforte,* first published in 1896 in England (reprint edition by Information Coordinators, Detroit, 1975). Hipkins reported that the 1720 piano had had new hammers of modern shape installed. He also stated that he had been able to play upon the 1726 piano in Paris at the Exhibition of 1878 and he found it "a complete and agreeable instrument with facile touch."

Until recently, the most complete and authoritative study on the 1720 and 1726 pianos was the work of Rosamunde E. M. Harding in her book *The Piano-Forte Its History Traced to the Great Exhibition of 1851* originally published in Cambridge, England, in 1933 (Reprint published by Da Capo Press, New York, 1973). Harding gathered a considerable amount of information on historical pianos in visits to museums and from other sources. In addition to providing data on the Cristofori pianos she observed, Harding prepared an excellent drawing which clearly shows the principles of the action in Cristofori's latest pianos. Harding's book was followed the next year (1934) by the report of Professor Schunemann of Berlin on the discovery of a portrait of Cristofori. The building containing the portrait was destroyed later during World War II, but fortunately reproductions have remained (*Journal* cover, May 1985).

Details on the circumstances of discovery of a third Cristofori piano, this one dated 1722, are not given in the recent references which list this instrument. The existence of this piano may have been made public in connection with the 1955 tricentennial celebration in Padua of Cristofori's birth. Russell's *The Harpsichord and Clavichord* published in 1959 listed Count Giusti, Padua, as owner. There is no mention as to whether Count Giusti was descended from Giovanni Battista Giusti, a late 17th-century harpsichord builder who was near the end of his career during the years Cristofori was beginning. The 1722 Cristofori piano is now on display in the Museo degli Strumenti Musicali, Rome.

Recent references with especially valuable information on the Cristofori pianos are the section "Pianoforte" in the 1980 *Grove Dictionary of Music* which contains material written by Edwin M. Ripin, who formerly served as assistant curator, Department of Music, Metropolitan Museum, and the study by Pollens previously mentioned. Pollens received a research grant from the Museum to travel and study the Cristofori pianos in Rome and in the Musikinstrumenten-Museum der Karl-Marx-Universitat in Leipzig. Pollens is the first investigator who has had the opportunity to closely examine all three Cristofori pianos. Other important studies by Mario Fabbri, who was recently a professor of music history at a school in Florence have been published in Italy. Fabbri was especially interested in the life and work of Cristofori.

How Many Pianos Did Cristofori Build?

Harding thought the Roman numerals "XX" found on the action frame in the 1726 piano perhaps was a serial number to indicate the 20th piano built. However, Pollens found the Roman numeral "I" on a rail supporting the action in the 1720 piano, certainly not Cristofori's first. The number of specific pianos known to have been built includes the one listed in the inventory of 1700 and four reported by Maffei plus three still existing to give a total of eight. Additional pianos which Cristofori probably built as indicated by indirect evidence include several provided to the Portuguese court at the recommendation of Domenico Scarlatti who served there 1719-1729 and at least one of the later types that went to Germany and served as a model for the Gottfried Silbermann pianos that are considered copies. Sulbermann could not have built these pianos from Maffei's 1711 article as suggested by some historians. Maffei's action drawing showed a design Cristofori abandoned before 1720. There is also the possibility that Cristofori did some work in his final years on the five pianos sent the Spanish court after Scarlatti went there from Portugal. We can only speculate how many others he built, considering that he also built new and rebuilt old harpsichords and provided other instrument maintenance.

A New Use For An Old Temperament

The New York Times music section, October 20, 1985, page 21, contains a report by Stuart Isacoff on a modern composition, "Suite for Violin, Piano and Small Orchestra" by Lou Harrison for performance with a piano tuned in the Kirnberger No. 2 temperament. While we are more accustomed to historical equal temperaments for performance of old music, such temperaments also offer posibilities for contemporary composers to create new sounds on the piano. Kirnberger No. 2, with all but three fifths pure, is easily tuned. This cycle produces three pure major thirds which contrast strongly with the others which are tempered, seven very wide. Other unequal temperaments with more gradual changes in interval size were more popular in the past and are usually preferred for present-day historical performance also.

Harrison composed his music to obtain the effects of the contrast in intervals and chords, alternating from sonorous ensembles with pure intervals to solo passages with "impure intervals to make the melody stand out from the orchestral accompaniment." Because of the unequal temperament of the piano, woodwind instruments could not be used. The instrumentation included strings, trombones, percussion and two harps tuned to correspond with the piano. The string players had to avoid playing on open strings.

TOOLS OF THE

TRADE

Cleaning Soundboards

Richard Hassig
Tri-City, IL, Chapter

Here is a procedure which I have found useful in the cleaning of soundboards. I am speaking here of cleaning a soundboard of a grand when the strings and plate have been removed and the piano is being rebuilt. You are welcome to try out the process and also I would appreciate comments about it. For that matter, maybe everybody already knows and uses it, but here goes:

Basically three ingredients are used. First, of course, you should remove as much dirt and debris as practical with a vacuum or Dust Buster or whatever you choose. I use a product called steel wool wax. I believe it is made for rubbing down finishes and may have other trade names, but that is what I know it by. I use it very sparingly with fine steel wool 4/0 or finer. I say sparingly and I mean that. Small amounts of wax, and small pads of the wool constantly changed and renewed is the best way. Go back and forth quickly with the grain of the board and keep moving; that is, don't stay in one spot. Follow up with a dry, soft cloth. You may want to do it again, and sometimes you may want to use plain wool a little.

"

.it is not an instant treatment. It requires fast movement and some work. But it does a good job and usually the lettering and things like that are very well preserved unless they have already been damaged.

"

I mentioned three ingredients. The wax, the steel wool, and the third is elbow grease. I don't mean that you must take all day at it, but it is not an instant treatment. It requires fast movement and some work. But it does a good job and usually the lettering and things like that are very well preserved unless they have already been damaged.

I have found that this same process works very well on plates when they are out of the grand if they are not all chipped up. Again, the lettering, if intact, is very well preserved. In the case of the board and even more importantly, the plate, it is a good idea to be sure that all excess wax is removed. I find for me it is preferable both on plates and boards than the use of soap and water, because you can tell more readily where it is, and if you don't get it all cleaned off immediately, it will not leave spots or streaks. Any you missed removing can be removed later.

What Kind Of Sandpaper Did You Use?

Del Fandrich
Sacramento Valley, CA, Chapter

Well, I don't think I have ever used any true "sandpaper." In fact, I doubt that you have, either. The products we call sandpaper are more properly called "coated abrasive sheets" and the abrasives used in their manufacture have about as much in common with ordinary sand as a little spinet piano has in common with a concert grand. The spinet and the concert grand are both pianos but . . . To be conventional, though, I'll continue to call those sheets of paper with all those jagged chunks of minerals glued all over one side "sandpaper," just like everyone else does.

The sandpaper products that we commonly use make up just one part of a larger class of tools that are referred to as "coated abrasives." These, in turn, are part of a larger class of tools that makes up the whole abrasives industry. Though they seem to be rather simple products, the abrasives we use are actually the result of some very sophisticated and highly specialized technologies that go into their design and manufacture.

Abrasive products are now commonly used in nearly every part of our industry, from the earliest stages of wood processing all the way through to the final tone regulating of the completed instrument. In fact, the piano, as we know it today, could not be produced without the extensive use of abrasives.

"Abrasive products are now commonly used in nearly every part of our industry, from the earliest stages of wood processing all the way through to the final tone regulating of the completed instrument."

This series of articles will discuss more than just sandpaper. In this article, we'll look at the minerals that are used to make the different abrasive products that are available to us. Later articles will cover specific sandpapers, grinding wheels, sharpening stones (and related products), buffing and polishing compounds, and other abrasive products as we come to them. First, though, let's take a brief look at how abrasives have developed throughout history.

History

One of the earliest abrasives known to have been used by man was a mineral called "shamir." Shamir is a Hebrew word mentioned in the Bible referring to a stone, probably emery, that was used for sharpening tools and

weapons. There are some ancient Egyptian drawings from roughly the same period of history that show abrasives being used to polish various pieces of jewelry and pottery.

Somewhat later, about seven or eight hundred years before Christ, and in another part of the world, southeastern Europe, another group of people are known to have used abrasives to keep their tools and weapons sharp. A statue called "The Grinder," now located in the Uffizi art gallery in Florence, Italy, shows an irregularly shaped natural sharpening stone being used to whet, or sharpen, a knife by a Scythian slave.

Some of the earliest forms of abrasive work was done with sand and flexible animal hide (would that be "sandhide?"). This was followed, quite logically, by attempts to fasten the sand to the hide with various adhesives. By the 13th century, the Chinese were attempting to fasten bits of seashell to parchment using natural gums as the adhesive. Ancient documents preserved from that period document these attempts. Some two hundred years later, Swiss craftsmen were using crushed glass affixed to a paper backing. This technique was used for quite some time. Several of the early books on piano building refer to this "glass-paper," as do early American and English books on furniture making and finishing. My grandfather, a German cabinetmaker who came to this country in 1903, called sandpaper "glasspaper" until the day he died. He knew that wasn't glass on the paper, but habits is habits . . .

Unfortunately, sand, seashells and glass lacked the sharpness and durability needed even by the industry of that time, so by the 19th century, a fairly wide variety of other natural abrasives — emery, corundum and garnet — were in common use. These materials were not only being used to coat paper or cloth to form sandpapers, but had been shaped into grinding wheels as well.

Although sandstone had been formed into wheels and used for grinding and sharpening, the first practical (modern) grinding wheel was made in 1873 by Swen Pulson to win a bet. He worked for the Norton and Hancock Pottery Company in Worchester, MA, at the time, and made a bet with some coworkers that he could make a grinding wheel by combining emery with potters' clay and firing the mixture in a kiln. He succeeded on his third try and won a jug of beer for his efforts. He also gave the world the vitrified grinding wheel.

Even this development and the improvements in natural coated abrasives were not meeting needs of a growing and thriving industry. By the end of the 19th century, however, processes for making aluminum oxide and silicon carbide in electric furnaces had been developed and both materials were quickly utilized in various abrasive products.

Natural diamonds were being used in grinding wheels by 1930, but it wasn't until 1955 when General Electric developed a process to manufacture synthetic diamonds that it became practical to use them in anything but very critical, i.e. costly, grinding operations. Like many other man-made materials, the synthetic diamond has proven to be superior to the natural material. (At least as an abrasive. I think my wife still prefers the natural stones — I'm not really sure why . . .) Diamonds are now used in production grinding wheels, and more recently, on a variety of tools intended to be used as, and replace, natural oil or water stones for sharpening knives, chisels, carving tools, etc.

At one time, abrasives were used only in the finishing stages of manufacturing, or where high-precision dimensional accuracy and smooth surfaces were needed. However, abrasive products are now considered to be essential industrial tools and they are being used at all stages of manufacturing. Higher grinding speeds and tougher grinding wheels — some of which are being driven by electric motors having more than 200 horsepower — have made abrasive machining an indispensible part of modern manufacturing. Improved abrasives and abrasive products have increased their versatility and made these products more useful for us as well.

Natural Abrasives

The first abrasive products were, of course, natural materials. As new synthetic materials are developed, most of the natural materials are being displaced; however, many of them are still important. Here are some of the more commonly used natural abrasives.

Diamond. The hardest of all abrasive products — in fact, the hardest material known. The main source of diamonds is South Africa, with smaller quantities coming from India, Brazil, Australia, Guyana and Venezuela.

Stones not suitable for gems, called "bort" or "boart," are desinated for industrial purposes. These are usually black or off-white in color. Some of these will be crushed into various sizes ranging from small pebbles down to fine powders. Once they have been crushed they are graded by size and shape.

Diamonds are used to make grinding wheels for a variety of applications ranging from heavy concrete cutting to fine finishing of tungsten-carbide cutting tools. Other uses for diamond abrasives include polishing powders, coated abrasive belts and polishing disks.

Corundum. A naturally occurring form of aluminum oxide, corundum is found mainly in South Africa with smaller quantities coming from India, Canada and the southern part of the United States.

Although it was once used for a wide variety of applications, in its natural form it was (and is) too inconsistent and its properties varied too greatly for it to be used for much besides polishing and glass-grinding. It was to overcome these inconsistencies that experiments were conducted to attempt to make synthetic corundum and the processes were developed to manufacture aluminum oxide. See *aluminum oxide.*

Emery. Another form of naturally occurring aluminum oxide, it is found mainly in Turkey and Greece.

Emery is even more impure than corundum. It consists of smaller crystals imbedded in an iron oxide matrix. It has a somewhat round shape which makes it useful for polishing. It is still used to make "emery cloth" sandpaper. Again, see *aluminum oxide.*

Flint. Or flint quartz. This is the most common abrasive used in the manufacture of sandpaper,

although it is hard to understand why. Flint is not very durable, nor is it hard enough to keep its cutting ability very long. It is the least expensive of all abrasives used in sandpaper, but not by much. Garnet paper costs very little more, but it works so much better and lasts so much longer there is really not much point in buying flint paper.

Flint is found throughout the world, but the best types for use in coated abrasives come from the eastern United States. These are usually grayish white to faint pink in color and are taken from open pit mines in lumps up to 10 inches in diameter. The lumps are then crushed into sharp crystals.

Garnet. A crystalline material, reddish brown in color. Much harder than flint, it is still a very valuable material for coated abrasives. In fact, besides flint, it is the only natural material used to make general-purpose sandpapers. It is much better than flint for sandpaper, also somewhat more expensive. But, as mentioned earlier, this extra cost is offset by garnet's superior performance as an abrasive. As the crystal edges break down, garnet actually shatters and exposes, or forms, new cutting edges.

There are seven known forms of garnet. The best for use in coated abrasives comes from the Adirondack Mountains in New York. It is mined by a process similar to that used in panning for gold.

Quartz. The main ingredient in sandstone. For years, sandstone was cut from natural deposits and formed into grinding wheels, sometimes called water wheels because they were generally used in a machine that held the wheel half-submerged in water. In these wheels it is actually the quartz that does the cutting. Quartz also is ground up for use an an inexpensive and disposable abrasive for sandblasting operations. When crushed, it is used in polishing compounds and buffing wheels.

My first experience sharpening anything was on an old sandstone grinding wheel on a North Dakota farm that I worked on as a teenager. I was given the job of sharpening all of the cutting teeth on a hay-cutting machine — I think there were about a hundred of them. I soon learned that a wet sandstone wheel, while it eventually did the job, left a lot to be desired as the ideal sharpening system. It was messy to work with, slow, and very inconsistent. I don't miss them at all!

Quartz is also found in dense stones in the United States and Belgium. These are used as honing and sharpening stones for putting the final edge on cutting tools and for honing machined parts to final size.

Pumice. The frothy part of volcanic lava. The best is found in Italy, where it comes from mines in lump form.

It is crushed into a powder and used as a very mild abrasive in a variety of products such as scouring powders ("use Ajax, boom, boom, the foaming cleanser, boom, boom . . .") and soaps. It is also used to polish metal, cut and polish glass, and as an abrasive polishing ("rubbing") material in the final stages of furniture finishing.

Tripoli. Named for the town in Italy from which it originally came. It is also called diatomite and tripolite — similar materials having different origins. Sources now include Iceland and Kenya as well as Missouri and Oklahoma in the United States.

Tripoli is a light-colored, fine siliceous material found in weathered chert — a very fine-grained, tough rock composed mainly of silica found commonly in limestone beds — or siliceous limestone.

Diatomite is an opaline silica — an earthy deposit formed mainly of the siliceous shells of diatoms, a microscopic algae whose cell walls contain silica.

When these materials are finely crushed, they are used much like pumice, i.e., in scouring powders, soaps and polishing compounds. They also are an important ingredient in the grease sticks used for charging cloth buffing wheels.

Rottenstone. The product of decomposing ("rotten") siliceous limestone. When impure limestone has decomposed to a friable — easily broken or crushed — state, it is pulverized and made into an extremely fine powder used primarily as a polishing compound.

Talc. A massive and foliated

(divided into very thin leaf-like layers) mineral, magnesium silicate. The softest and mildest of all abrasives, it is used as a polishing compound and sometimes as a lubricant.

Others. There are a few other little-known natural abrasives which are used for highly specialized cutting or polishing operations, but those listed above are the only ones we are likely to come across. In fact, several of these are the only ones we are likely to come across. In fact, several of these are not being used much any longer. Manufactured abrasives are replacing many natural materials as they continue to be developed and improved. The manufactured product can be tailored to specific applications and can be produced to have more desirable and consistent characteristics.

> "... silicon carbide and aluminum oxide ... have become the two most important manufactured abrasives."

Manufactured Abrasives

Although manufactured abrasives have been around since 1891, it wasn't until the 1970s that they replaced the natural materials in the quantities used. The development of the electric furnace in the later part of the 19th century made the production of silicon carbide and aluminum oxide possible.

These two materials have become the two most important manufactured abrasives. Since each requires huge amounts of electrical power in their manufacturing processes, they are usually made in furnaces located near cheap and plentiful power sources.

Silicon Carbide. In 1891, Edward G. Acheson, an electrical engineer working in Monongahela City, PA, combined a mixture of clay and powdered coke in a small electric furnace. The resulting crystals were very hard — hard enough to scratch glass — and shiny. One of the first uses for this new material was to polish glass and precious gem stones. At first, though, the cost of the silicon carbide was nearly equal to that of the gems it was used on. It is now considerably less expensive and is used at a rate second only to aluminum oxide as a synthetic abrasive material.

The manufacturing process is relatively simple and is still basically the same as that worked out by Acheson in the 1890s. Pure silicon sand is mixed with carbon (ground coke) and formed around a carbon conductor within a trough-shaped brick furnace. These electrodes are about 40 feet long, 10 feet wide and 10 feet high. They have electrodes at each end. Electrical current is passed through the conductor, heating the mixture and bringing about a chemical reaction in which the carbon and silicon combine to form silicon carbide. A little sawdust has been added, making the mixture porous as it burns away and permits the escape of large quantities of flammable gas. Once the furnace run is complete, some 36 hours later, the product consists of an extremely hot — about 4,000 to 4,500 degrees fahrenheit (2,200 to 2,480 degrees centigrade) — core of silicon carbide loosely knit together. This core is surrounded by partially or completely unconverted raw material at somewhat lower temperatures — only 2,500 degrees fahrenheit (1,370 degrees centigrade). One furnace run will consume approximately 100,000 kilowatt-hours of electricity and will produce approximately 25,000 pounds of silicon carbide.

The quality of the silicon carbide depends on the raw materials chosen and the accuracy and control of the furnace run. Silicon carbide is one of the hardest and toughest materials currently in common use as an abrasive. Its shape, however, is almost sliver-like, which means that under rough service it fractures easily.

Aluminum Oxide. Developed shortly after silicon carbide, aluminum oxide has now become the most important abrasive in use. More aluminum oxide is used annually than any other abrasive material, natural or man-made.

The first successful attempts to make aluminum oxide were in the laboratories of the Ampere Electro-Chemical Company in Ampere, NJ, in 1897. Although there are records of earlier attempts to make corundum and emery, both of which are naturally occurring forms of aluminum oxide, this was the first experiment that worked. Several hundred tons — this must have been quite an experiment — were distributed throughout the industry during the next several years and there was enough interest in the new abrasive to bring about full-scale industrial production in 1901.

The raw material is bauxite, which actually contains aluminum oxide, along with water and various other impurities. Bauxite is a

very plentiful mineral, coming mainly from Guyana and the United States.

The bauxite is heated to drive off the excess moisture before being placed in an electric arc furnace. Here it is heated to something over 2,000 degrees fahrenheit, a temperature which melts the bauxite and reduces most of the impurities to their base metals. Small amounts of coke and iron are added to help these impurities settle to the bottom of the furnace. What is left at the top is aluminum oxide. After the furnace run is complete — it takes about 16 hours — its outer shell is removed and the chunk of aluminum oxide is allowed to cool. The cooling rate determines the type of crystal structure that will be developed. Depending on the desired results, it will take anywhere from one day to one week for the mass to cool.

Although it is not the hardest material used on coated abrasives, it is the toughest due to its heavy wedge shape. The shape of the grains can be varied by using different types of crushing techniques. Those used for metal finishing will have a broader, heavier shape than those used for wood and finish sanding.

Synthetic Diamond. Natural diamonds were being used in abrasive wheels as early as 1930, but their high cost prevented their use in anything but the most critical machining operations. In 1955, General Electric announced a process that made the commercial production of diamonds possible. Since then, diamonds have been used in many more less critical (translation: less expensive) applications.

Synthetic diamonds are formed by subjecting graphite to extremely high pressures (up to 1,500,000 pounds per square inch) and high temperatures (above 5,000 degrees fahrenheit or 3,000 degrees centigrade). Most of the diamonds made this way are of industrial quality, not gem quality — although that is being worked on, as you can well imagine.

As the cost of industrial diamonds comes down, we'll begin to see them used in many more ways — ways that even we piano technicians can benefit from. I already have several tools which use synthetic diamonds, and I expect to have more as time goes on.

Others. There are many other abrasives in use industrially, but most of them are of little interest to us. They are either extremely expensive or of very limited purpose. Boron carbide and boron nitride, for example, are both very hard abrasive materials, but they fracture so easily and are so costly to produce (at least currently) that, while they may be very useful for certain specific applications, it is unlikely that we will ever come across them in our work.

Glass beads, metal (bronze, iron, steel and steel alloys) shot and silicon sand make up another abrasive technique loosely referred to as "sand blasting." Steel wool, and more recently "plastic wool," have both become important abrasive products in many industries, including ours. These materials are most useful during the finishing, or refinishing, but they have other uses as well. I'll be writing about these and other materials in later articles.

PIANO TUNING

Procedures, Part I

Daniel Ressl
Vancouver, BC, Chapter

During the last 10 years, I have enthusiastically studied piano tuning by analyzing and practically testing dozens of tuning procedures presented in numerous books, *Journal* articles and Piano Technicians Guild seminar classes. I have observed several tuners tuning and the results they and I achieved on various pianos under specific circumstances.

My conclusions are so straightforward that they could be grasped in far less than 10 years. Not finding a presentation of these conclusions together elsewhere, I felt obligated to write this essay for the benefit of those who would like to tune pianos beautifully but don't want to spend years just searching for the right questions to ask.

An old tuner once told me that he thought it was strange that by the time a fellow really learns to tune, it's time to retire. Maybe a lifetime of experience can't be gained except through a lifetime of experience; then again, I sure wish that I had this essay to guide me 10 years ago!

Historically, the main approaches to piano tuning have been meantone, well and equal temperaments. Procedures for tuning each are described here. The easiest tuning, perhaps the one to try first, is Werkmeister's well temperament, which also easily converts into meantone.

Regarding setting equal temperament by fourths and fifths instead of by thirds and sixths, I have found that since inharmonicity causes greater deviations from theoretical relationships between higher partials and fundamentals than between lower partials and fundamentals, tuning 3:2 fifths and 4:3 fourths and bending them only as far as is required to accommodate thirds and sixths, gives more consistent results than tuning thirds and sixths and bending them only as far as is required to ensure acceptably slow fourths and fifths. Check it out when you tune two pianos which are to be played together.

I concocted the one-beat-per-second equal temperament, and my favorite well temperament, but I wouldn't be surprised if others had previously invented them. They are here to be used and enjoyed, whoever wishes to claim discovery. Now, on to a discussion of perhaps the most important aspect of piano tuning, so matter which temperament procedure you prefer, tuning stability.

Tuning Stability

Since recording studio pianos are tuned prior to each recording session, and concert pianos are tuned prior to each performance, recording and concert artists judge these tunings stable if the tunings hold up under a few hours of sometimes hard playing.

On the other hand, ordinary piano owners judge stability over weeks, months and years. Certain factors destroy the piano's tune. Temperature and humidity fluctuations force soundboard expansion and contraction. Either the weather should be controlled or the piano may need tuning every two weeks. New or repaired strings go out of tune as the new wire stretches or the new knots tighten. Loose tuning pins won't hold strings in tune. A poorly constructed piano, or one with a fatigued or loose structure can't hold a tuning for long.

Even a solidly built piano shifts internally as it is tuned, and the greater the required string tension changes, the less stable the tuning. When a piano is moved to sit differently on the floor, its frame twists a bit because pianos are heavy, and the altered string support alters the tuning. A piano bumped or dropped in moving, played too hard or tampered with loses its tuning.

Instead of throwing one's hands up in despair over such a hopeless situation (even if the piano owner refuses to: a. keep plants off the piano; b. install a humidifier; c. invest in a solidly built instrument; d. have it tuned at least once a year so the overall string tension won't fall so far that drastic string tension changes are required to bring the piano back to tune; e. keep the kids from pounding the keyboard with fists, hammers or toys; f. refrain from inserting paper clips and washers between or under piano strings in order to evoke sounds the piano is not designed to produce) a piano tuner can do certain things correctly to stabilize tuning.

Technique

1. It may be impossible to avoid bending the tuning pin a minute amount while turning the pin. Within a few hours of being bent, a tuning pin springs back to its original shape. If the tuning pin is bent towards or away from the speaking length of the string, it sharps or flats the string's tuning as it straightens. If the tuning hammer handle is in line with the string,

the pin may be bent side to side, but will not alter the tuning when it straightens. The tuning hammer should be placed as closely as possible in line with the string leaving the pin.

2. If standing increases control of the tuning hammer properly placed on the pin, stand while tuning rather than placing the hammer wrong to accommodate sitting.

3. The tip of the tuning hammer should be as short as possible while still allowing the handle to clear obstructions. Also, the tip's hole should be loose enough to allow the tip to get in close to the coils of the tuning pin, but not so loose that control is sacrificed. A star tip, instead of a square tip, allows placement of the handle more closely in line with the string. A short tip that fits the pins reduces bent tuning pins.

4. The visible part of the tuning pin can be turned without the end embedded in the pinblock following 100 percent. When this pin eventually untwists on its own, it knocks the string out of tune. In order to move the whole tuning pin, it is far superior to move the hammer by means of quick, tiny jerks, rather than slow, steady pulls or pushes. Hand and fingers should be near the handle end for the greatest leverage and finest control. See *Figure 1.*

5. Prior to actual tuning, the string should be knocked a small amount flat. This reduces string breakage by breaking loose rust at the several points of bearing and friction along the string length. By sensing the lowering pitch in relation to tuning hammer movement, the tuner can judge how hard to pull when bringing the string to pitch.

6. Some pianos respond better to overpulling and backing off to pitch, and other pianos respond better to simply coaxing to pitch. Aim to leave the tuning pin in a relaxed state.

7. Sound the string whenever turning the tuning pin. Play the piano key louder when tuning than the performer will play. A piano string passes over and around as many as six friction points from tuning pin to hitch pin. Loud playing equalizes the tension throughout the string's length by overcoming friction at bearing points. Otherwise, excessive slack or tension left in a string portion will work its way around to alter the tuning, perhaps the first time the piano is played.

8. Since a piano won't hold tuning when string tension changes force structural changes such as soundboard compression, you cannot tune at the same time as raising or lowering the overall pitch of the entire piano. It is better to go over the piano twice, first to approximate the desired string tension as quickly as possible, because fine tuning done now won't be there when you come around to it again anyway, and then go over it again, tuning it where you intend it to stay. Strip mute the entire piano, leaving one string of each unison to sound. Tune only one string per unison over the entire piano. Then tune the remaining previously muted strings right to left in the treble and left to right in the bass. This tuning reduces bridge roll and soundboard strain and facilitates fast work.

9. Tune unisons clean. Unison third or fourth partials, instead of fundamentals, in the center of the piano, and fifth or sixth partials in the bass. Listen to all of the strings of a unison together and clean it up, instead of only comparing each outside string to the central string. The closer the unisons, the farther everything will have to drift before retuning is required.

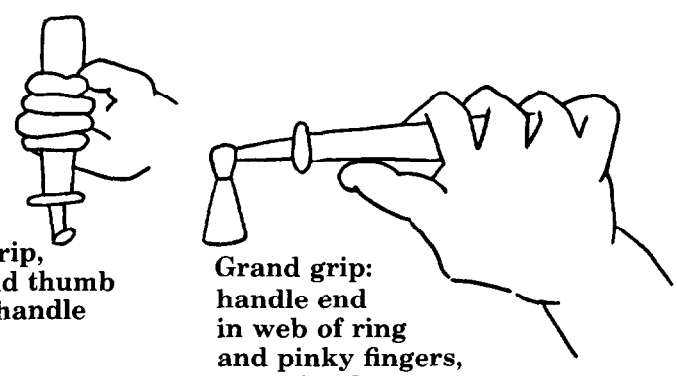
Counting Beats

Beats indicate perfection in piano tuning by defining the harmonious quality of simultaneously sounded tones. The number of beats per second (bps) describes how smooth or busy an interval sounds.

Three beats in five seconds (.6 bps) is counting once for every two ticks of a metronome ticking 72 per minute, or if your metronome goes this slowly, counting once for every tick at 36 per minute; or counting three equal counts per five-second passage of a clock's second hand. One beat per second can be accurately counted by measuring three beats in three seconds against a digital watch which flashes once per second. The watch display is also useful to establish two, four, six and eight beats per second. At one half-note per second, quarter notes come two per second, eighth-notes four per second, triplet eighths six per second and sixteenth-notes eight per second. *Figure 2.*

Piano tones are named and numbered left to right from A1 to

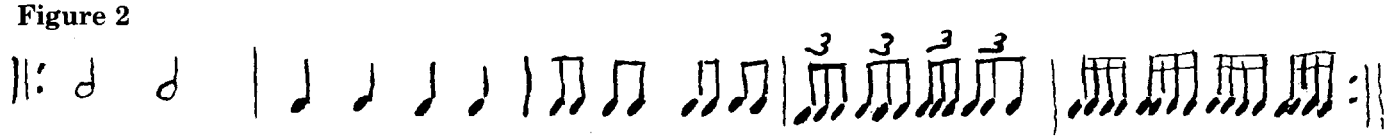
Figure 1



Upright grip, fingers and thumb grasping handle

Grand grip: handle end in web of ring and pinky fingers, spread palm

Figure 2



1 per second **2 per second** **4 per second** **6 per second** **8 per second**

Tuning . . .

C88. Focus the ear by playing the coincident partial tone involved. Sustain A37C40, a minor third, and staccato plink E68. Sustain A♭36C40, a major third, and staccato plink C64. Sustain G35C40, a fourth, and plink G59. Sustain F33C40, a fifth, and plink C52. Sustain E♭31C40, a major sixth, and plink G59. Sustain C28C40, a bass octave, and plink G59. Sustain C40C52, a mid-range octave, and plink C64. Sustain A♭24C40, a major tenth, and plink C52. Sustain C28, a bass unison, and plink C52, E56 and then G59. Sustain C40, a mid-range unison, and plink G59 and C64. Treble octaves, for example C64C76; seventeenths, for example A♭24C52; and minor twenty-firsts, for example D6C40, concide and produce a beat at the upper tone of the interval. Treble unisons, for example C76, beat most strongly at their fundamental tone. Other partials may also beat in these various intervals, but these are the partials which should be tuned. The partial involved is related by the same number of keys to a particular interval, regardless of the interval letter name.

Extreme treble beats may fade too rapidly to guide tuning. Pick the strings involved with a fingernail to compare pitch. Too many beats may rumble in the extreme bass to guide octave tuning, so a subjectively guessed octave is then fine-tuned to the test interval. When the ear stops perceiving the beats as clearly as it did a few minutes before, simply do something else for awhile to rest it. When you can relax and count beats as freely as visually counting clouds in the sky, you can hear beats all day. Sometimes a piano wire beats when sounded by itself. The beat can be tuned as close as possible to the desired rate, such as zero beat in a clean unison, or if this is impossible, the pitch is merely set by ear, ignoring the beat. Correcting false beats, and repairwork in general, exceeds the scope of this essay. For repair work refer to Reblitz's *Piano Servicing, Tuning and Rebuilding*, which contains many explanatory photographs and detailed repair procedures.

Next Month: "Temperaments"

The Auxiliary Exchange

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Profiles . . .

This is the first in a series of biographical articles on our past presidents. ***Dessie Cheatham*** *expressed her feeling for PTG and PTGA so well we are making this first one autobiographical.*

I was born in Hoisington, KS, March 13, 1909. We moved to LaCrosse, KS, when I was about one year old. My dad finally leased a large brick building on the corner for his toy and confectionery store. Across the street on the other corner the Cheathams had a store. So from about four years old, Paul and I played together. We got separated by several moves, but I always seemed to get a letter from Paul.

We were married in 1929 and had two sons, Lentz Irvin and Val Rhys. We celebrated our 40th anniversary with friends and relatives. Piano tuners or their wives gave the program. It was a very big day.

I can't remember the date I went with Paul to my first PTG convention, but it was in San

From The President

It is time to start getting excited about Las Vegas! It is a long way from Georgia! To fly or to drive is one question many of us will have to ask! I had no idea there were so many things to do there! Our Vice President, **Ginger Bryant**, was at the planning meeting and she has "cooked up" some marvelous things for the Auxiliary members to do! We'll tell you the details as soon as they are finalized.

Ginger went to the planning meeting for what turned out to be two reasons instead of one — she lives on the West Coast and I was supposed to be teaching. However, I couldn't go because I had surgery then.

I know you will be as pleased as I am about the program! Some of you have asked that we print the entire program in the *Journal* so that you can plan for your children. This will be done. Thanks for a fine suggestion. I'm sure that more of you have other good ideas. Please take a minute to jot them down on a scrap of paper and send them to me.

I hope that you took the time to read our Fall Newsletter! Many thanks and congratulations from all of us for a job beautifully done by **Agnes Huether,** editor, and **Julie Berry** production assistant.

Don't forget *Christmas in July!*

— Louise Strong

Diego, and I attended all the conventions. After that I was elected second vice president and membership chairman and really helped with many new members. I always felt if we could keep the wives happy and busy the men could attend their meetings. For many years I guess the PTG and Auxiliary was our lives. In fact, those were the happiest days of my life. I feel like I gave a lot to our Auxiliary and so enjoyed doing it.

One year as I was president, we celebrated several special days — Ruth Pollard Day, Esther Stegeman Day and others which I really did enjoy. They seem to add spice to our organization.

Seven years ago we were in a car accident, and Paul was killed instantly. But after time in the hospital and in bed at home, I made it through the ordeal.

This past year, the convention being in Kansas City, I was able to attend, which again gave me many happy days of memories. I hope to attend if I possibly can from now on. The organization has grown and does many very interesting things.

Just a word or two for a good laugh. We took one of our grandsons, then 14 years old, to the convention. After we were there awhile he asked me why I didn't tell him we had relatives there. He had taken note of all the kissing and hugging. So I tried to explain to him we had no relatives there, but we considered all those people very dear to us. Which they always will be.

I live alone, which is a very lonesome life. I do get to see some of my dearest friends, Lu and Ernie Preuitt, every now and then, as I have a grandson who lives 20 miles from Kansas City.

I hope that many other Auxiliary members get the pleasures and happiness it has brought me. Like this year at the luncheon, at my place was a beautiful bouquet signed, "To their ex-president from her ex-officers." Again, may I especially thank Helene Kingsbury for having been responsible for it. When I was president and had spent so much money on flowers, Helene had worried, as she was the treasurer. But I guess there must have been some left to carry on with. I feel in all of life as well as in the Auxiliary we get returns on all we put into the organization. So please girls, do all try to help and keep this the best organization there is today.

With all my love to all of you.
Dessie Cheatham
Past-President, PTGA

California State Conference Is . . .

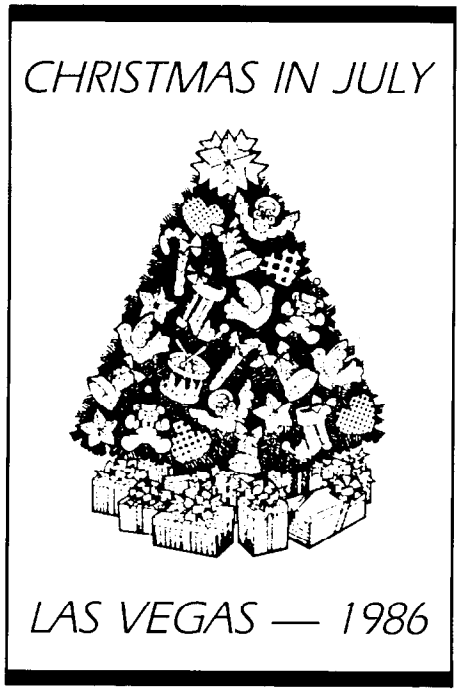
. . . just a couple of weeks away, but it is still not too late to go to sunny San Diego. A full Auxiliary program is planned. Be sure to pack your bathing suits, as the Town and Country Inn has three swimming pools and in San Diego they are often used in February.

The Pennsylvania State Conference Will Be . . .

. . . April 4-6 at the Holiday Inn in downtown Harrisburg. If you are from Pennsylvania, go and see where your money is. If you are not from Pennsylvania, go and find out why the PSC is always heralded as one of the top conferences of the year. Pennsylvania is delightful in the spring and **Crystal Bowman,** president of the South Central Chapter of PTGA is busy arranging Auxiliary activities that will make your weekend most enjoyable.

April 4 — Friday — noon: Auxiliary luncheon "poolside" with special entertainment in the hotel. April 5 — Saturday: **Mr. Robert Rook** of the Pennsylvania State Library will take the Auxiliary on a walking tour of historic downtown Harrisburg. Lunch will be dutch treat at an international restaurant in Strawberry Square with some time left for a shopping spree.

The banquet will be Friday evening and **Beth** and **Truman Bullard** (professors of music at Dickinson College) will perform for us. Piano and flute before dinner, harpsichord and flute after dinner.



Christmas In July

Reports have been coming in from throughout the country indicating enthusiasm for our "Christmas in July" project with Auxiliary chapters and individual members already making things to place on or beneath our Christmas Tree at the summer convention in Las Vegas July 21-25.

The grand prize for the raffle has been purchased. It is: "LGB," the first large scale model train, for indoor and outdoor use, for father and son and the entire family. Weatherproof. G-gauge — 45 mm., scale 1:22.5. Imported from Germany.

Translated into language I can understand: The red and green engine is about eight inches high. It comes with two freight cars (one red and one green), a transformer and enough large track to circle the Christmas Tree. When it is displayed at our convention, the freight cars will be filled with gaily wrapped Christmas presents that will be additional surprise gifts for the lucky winner.

The train retails for between $250 and $300 so the odds may be just as good as those you will get elsewhere in Las Vegas. With us, if you win you are *sure* you will take all of your winnings home with you!

Getting The Organizational Spirit

Put Your Heart Into It!

M.B. Hawkins
Vice President

February is the month when many people focus on the activities of the heart, so why can't we do the same?

You know when activities are undertaken by people who really put their heart into the undertaking, it is no less than amazing what can be accomplished. I believe we can look back at the progress of the Guild and easily recognize that many people have for years now put their hearts into their activities within our organization.

Since this is February, it seems appropriate to challenge some of our less active members to identify an area of activity which will help us move forward and put their hearts into achieving that goal. I invite you to write me and share your thoughts. You may have a super thought about a chapter program, a chapter field trip, a committee you would like to work with, or the direction you would like to see us direct our energies. Whatever your thought, share it, won't you?

While we are talking about things we can put our hearts into, let's not forget to really put our hearts into introducing the Piano Technicians Guild to those not yet aware of what we are about. Our communications director in a recent report makes this very point. Each of us must involve ourselves in the advertisement of our organization. That is the only way we will keep our organizational spirit surging.

Region 1

Boston Chapter 064
5 Lynn, Paul D.
Bradford Corner Road
Woodstock Valley, CT
06282
(New Member)

L.I.-Suffolk Chapter 117
1 Dowling, James V.
132 Foxdale Ln.
Port Jefferson, NY
11777
(New Member)

L.I.-Cristofori Brotherhood Chapter 118
1 Traxler, William E.
43 Hawkins
Stony Brook, NY 11790
(Reclass from
Apprentice)

Erie Chapter 165
8 Fellows, Bruce H.
R.D. 1
Little Valley, NY 14755
(New Member)

Philadelphia Chapter 191
8 Kling, Roger W.
2140 Barr Rd.
Wilmington, DE 19808
(New Member)

Wilmington Chapter 198
8 Kazanjian, Judy L.
332 Wellington Rd.
West Chester, PA
19380
(New Member)

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2 Guild Sustaining
3 Chapter Sustaining
4 Allied Tradesman
5 Apprentice
6 Associate
7 Honorary
8 Student
9 Affiliate

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5 Basdavanos, Michael D.
210 N. Payne St.
Alexandria, VA 22314
(New Member)

Pamlico, NC, Chapter 278
1 Anderson, Francis E.
1016 Colonial Ave.
Greenville, NC 27834
(New Member)

Central Florida Chapter 327
8 Carter, James W.
1907 Mae St.
Orlando, FL 32806
(New Member)

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1 Clark, Mark E.
2511 Durwood St.
Austin, TX 78704
(New Member)

El Paso, TX, Chapter 799
8 Benson, Caroline
1132 Baltimore Ave.
El Paso, TX 79902
(New Member)

Region 4

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8 Walker, Kathalin R.
6459 N. Central Ave.
Indianapolis, IN 46220
(New Member)

Waukegan, IL, Chapter 600
8 Praska, Susan J.
9253 First Ave.
Kenosha, WI 53140
(New Member)

Chicago, IL, Chapter 601
6 Pierce, Paul E.
2279 Jericho Rd.
Aurora, IL 60506
(New Member)

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1 Jones, Kenneth A.
6782 Mignon
Florissant, MO 63033
(New Member)

Region 6

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1 Coplin, Michael E.
Box 17771
Fountain Hills, AZ
85268
(Reclass from
Apprentice)

Tucson, AZ, Chapter 857
1 Kattija-Ari, Kathleen M.
4743 E. Bellevue
Tucson, AZ 85712
(New Member)

Eugene, OR, Chapter 974
5 Phillips, Alan M.
89084 Blue View Dr.
Veneta, OR 97487
(New Member)

Seattle, WA, Chapter 981
8 Grassi, Jeannie C.
9170 Ferncliff Ave.
N.E.
Bainbridge Island, WA
98110
(New Member)

8 Martin, Cathy A.
16214 S.E. 9th St.
Bellevue, WA 98008
(New Member)

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Coming Events

Date	Event	Site	Contact
Feb. 21-23 1986	California State Conference	Town & Country Hotel San Diego, CA	Don Mannino 4243 Blackton Dr. La Mesa, CA 92041 (619) 461-7559
Feb. 22, 1986	Washington D.C. Seminar	Ramada Inn Beltsville, MD	Joyce Meekins 20-E Ridge Rd. Greenbelt, MD 20770 (301) 345-3555
Mar. 7-9 1986	North Central Louisiana Seminar	Regency Motor Hotel Shreveport, LA	Charles Richey 112 E. Robinson St. Shreveport, LA 71104
Mar. 13-15, 1986	Pacific Northwest Conference	Red Lion Inn Bellevue, WA	Steve Brady 22808 35th Ave. West Brier, WA 98036 (206) 543-0543 (206) 771-7781
Mar. 14-16, 1986	Central West Regional Seminar	St. Louis, MO	Rohnn Kostelecky 923 Pike St. Charles, MO 63301 (314) 946-2483

April 4-6 1986	Pennsylvania State Convention	Harrisburg, PA	James N. Hess 511 Miller Ave. Mechanicsburg, PA 17055 (717) 790-9670
April 18-20, 1986	New England Regional Seminar	The Lowell Hilton, Lowell, MA	Nancy Walker Parry 125 Hartford Street W. Natick, MA 01760 (617) 653-2747
April 19, 1986	Los Angeles Seminar	Los Angeles, CA	Claudia Ellison 3137 Voltaire Dr. Topanga, CA 90290 (818) 348-4735
May 10, 1986	Northern California Seminar	Davis, CA	Yvonne Ashmore 12700 LaBarr Meadows Grass Valley, CA 95949 (916) 273-8800
May 16- June 6, 1986	Study Tour of Europe	East & West Germany, Austria Czeckoslovakia	Dan Evans 4100 Beck Ave. Studio City, CA 91604 (818) 762-7544
July 21-25 1986	Piano Techicians Guild Annual Convention and Institute	Caesars Palace Las Vegas, NV	Home Office 9140 Ward Parkway Kansas City, MO 64114 (816)444-3500

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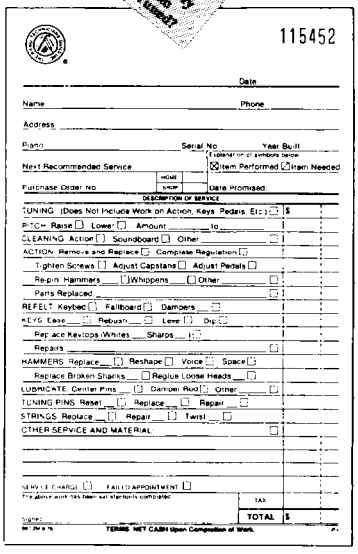
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Date

Name _____ Phone _____

Address _____

Piano _____ Serial No. _____ Year Built _____

Next Recommended Service _____ ☒Item Performed ☑Item Needed

Purchase Order No. _____ Date Promised _____

DESCRIPTION OF SERVICE

TUNING (Does Not Include Work on Action, Keys, Pedals, Etc.) ☐ $

PITCH Raise ☐ Lower ☐ Amount _____ to _____

CLEANING Action ☐ Soundboard ☐ Other _____

ACTION Remove and Replace ☐ Complete Regulation ☐

Tighten Screws ☐ Adjust Capstans ☐ Adjust Pedals ☐

Repin Hammers _____ ☐ Whippens _____ ☐ Other _____

Parts Replaced _____

REFELT Keybed ☐ Fallboard ☐ Dampers _____ ☐

KEYS Ease _____ ☐ Rebush _____ ☐ Level ☐ Dip ☐

Replace Keytops Whites _____ Sharps _____ ☐

Repairs _____

HAMMERS Replace _____ ☐ Reshape ☐ Voice ☐ Space ☐

Replace Broken Shanks _____ ☐ Reglue Loose Heads _____ ☐

LUBRICATE Center Pins ☐ Damper Rod ☐ Other _____ ☐

TUNING PINS Reset _____ ☐ Replace _____ ☐ Repair _____ ☐

STRINGS Replace _____ ☐ Repair _____ ☐ Twist _____ ☐

OTHER SERVICE AND MATERIAL _____ ☐

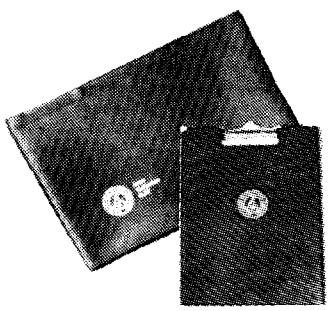
SERVICE CHARGE ☐ FAILED APPOINTMENT ☐

TAX

TOTAL $

Signed _____

TERMS: NET CASH Upon Completion of Work.



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	Quantity Ordered	Total Price
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★ **Pamphlets** — 100/$11 — 500/$50		
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Reminder Cards		
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★ **Teacher Recital Program Covers** — 100/$8		
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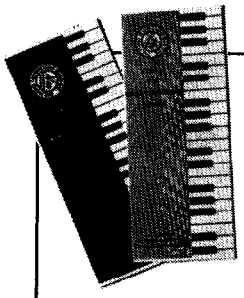
Enclose check or money order for this amount
U.S. FUNDS TOTAL

Registered Technician YES☐ NO☐



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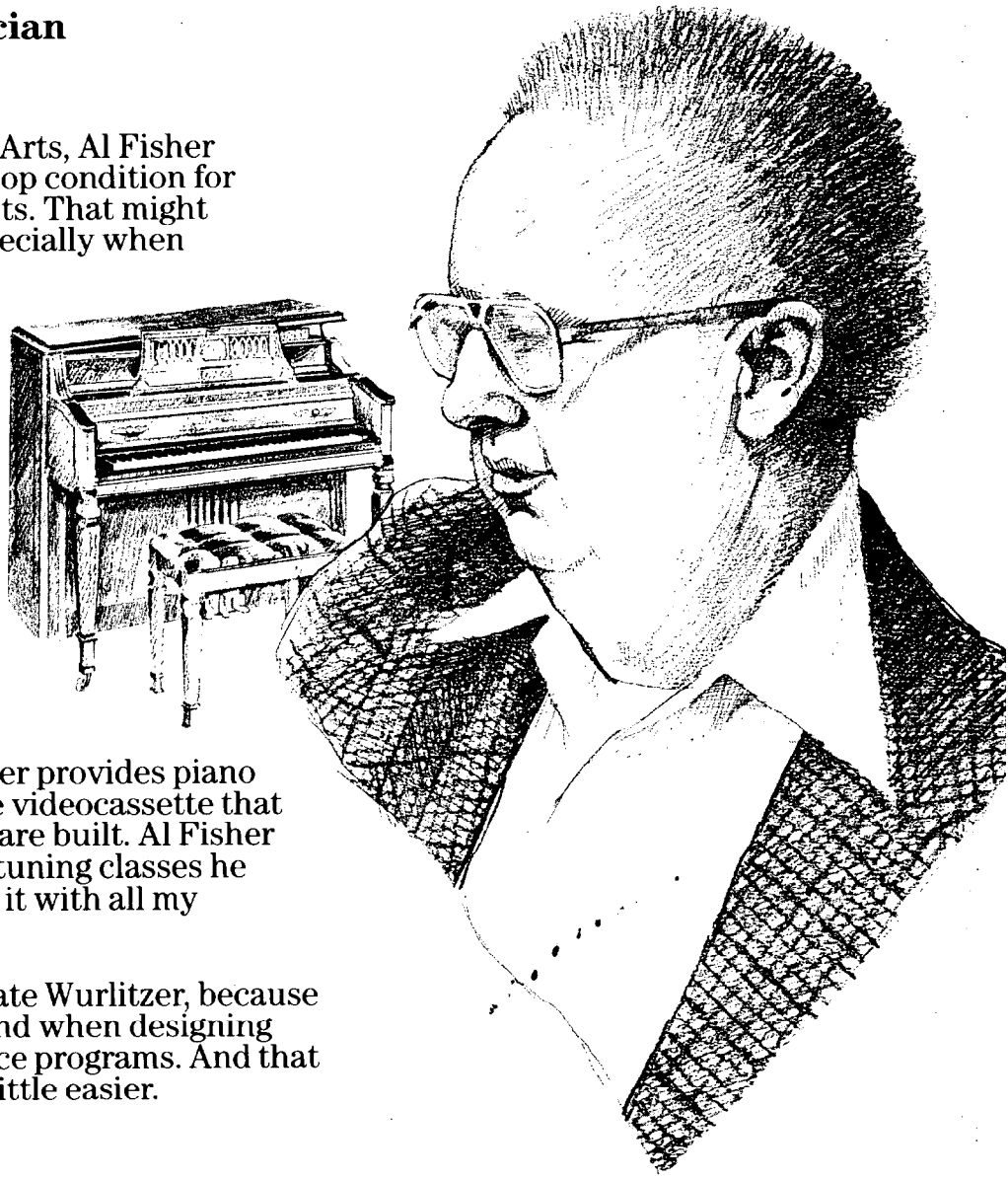

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