



Maintenance Voicing: A Practical Approach to Improving Sound in Heavily Used Pianos

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In piano maintenance, voicing is arguably the highest-benefit, yet most avoided procedure. The main reasons for this are: burdensome prep expectations, ambiguous listening methods, confusing array of techniques, impermanence of results, inadequate time, and inability to deal with fatigue.

We are taught that a piano can be voiced reliably only if impeccably prepped with precise action regulation, perfectly level strings, and fully reshaped and mated hammers. This is good advice when voicing a new set of hammers, or when the goal is best voicing results. However, in the context of older and heavily used pianos (which is the majority of work for many piano technicians), I would like to challenge those assumptions so that you can do more of what makes the greatest difference to the piano owner — actual voicing. Remember that most piano owners (especially professional musicians) don't seek perfection, but improvement.

Another reason for voicing anxiety is that we are taught overly complex listening methods. I am proposing musical patterns, from simple to more demanding, that quickly reveal issues with balance and evenness without causing unnecessary ambiguity and ear fatigue.

For a quick voicing to be feasible and produce permanent results, the voicing technique has to be simple, thorough, and effective. I recommend a conventional, single-needle voice-down method, and two methods for voicing up with a chemical hardener.

Our ability to voice the piano relies on our perception, which depends on our energy and mood. When we get fatigued, whether aurally or physically, our perception changes. The best way to curb fatigue is to limit one's voicing to a pre-set amount of time. This method allows you to stop anytime and still leave the piano sounding better than when you started.

While I advocate relaxing many prerequisites for maintenance voicing, the one I staunchly defend is the tuning. Always tune the piano before you voice it — at least, touch up the unisons. An out-of-tune temperament is musically disorienting, whereas even slightly out-of-tune unisons will sound louder and alter your perception of tonal envelope (how attack, bloom, and sustain relate to neighboring notes). The overall pitch determines multiple aspects of sound.

Generally, raising the pitch will:

- Increase sound energy
- Reduce inharmonicity and needed stretch
- Increase string downbearing and soundboard impedance

- Increase and even out sustain
- Reduce inherent discrepancies in attack, bloom, and sustain

Throughout this article, please keep in mind that I am in no way diminishing the importance of good prep for optimal results. When you have the time to thoroughly clean, lubricate, and regulate the action, by all means do it before the voicing. Leveling the strings and finessing hammer mating pay huge dividends in voicing evenness and stability. Also, I recommend allocating several hours for a thorough voicing whenever you can. However, when faced with not enough time and too many pianos to take care of, ask yourself what will provide greater benefit — a thorough service on fewer pianos, or focusing on highest priorities from the pianist's standpoint and covering more pianos? This article explores how to voice with the latter approach.

You will notice that I don't differentiate between softer, voice-up hammers and denser, voice-down hammers. This is because the hammers have already been treated to work in the piano, and similar needling techniques apply to both. However, you may need to adjust the amount of needling, and needling dense or overhardened hammers will be physically more difficult. Dense hammers are usually not needled enough on the shoulders and often have a hard, stiff sound and inadequate sustain, but deep-needling the shoulders is outside the scope of maintenance voicing.

Preparing and Evaluating

Tune the piano well. Out-of-tune unisons sound louder and obscure the attack noise.

Play *mf* to *f* in different sections and take first impressions of the tone with the fallboard in, lid down, and music desk up. Mark keys with chalk or write down the notes that are loud and/or bright, as well as those that are too soft or mellow.

Tighten the end blocks and check the following:

- Is hammer alignment OK? If grossly uneven, you may be forced to reshape the hammers so that you can travel shanks, square hammers, and realign hammers to strings.
- Does the keyframe rest block need shimming? If most hammers are aligned to the strings too far to the left, you may need to shim the rest block. I recommend cutting two shims the size of the block out of relatively thin card stock. Two layers usually restore the original alignment. More layers will

cause the grooves to be misaligned with the strings and would voice down the piano by placing unworn areas of hammers in contact with strings. This is in fact a technique that some piano salespeople use to make a worn piano sound more acceptable — they insert a business card or two between the keyframe and the rest block. This is *not* recommended, as it stresses the shank center pins and causes the hammers to wear rapidly. Be sure to re-regulate the soft pedal and check the adjustment of the shift stop screw (explained below).

- Is the strike position optimal? Check this by removing the treble end block and moving the keyframe in and out while playing within the top two sections. If necessary, adjust the position of the brass plate in the end block.
- Do end blocks need adjusting vertically? On key 1 and key 88, hold down the key loosely with one hand and pound it with the other. If there is a knocking or slapping noise, adjust the end blocks later by trimming their shims thinner.
- Is the balance rail bedded? Thoroughly bedding the whole frame is not necessary, but you should make sure the balance rail is firmly bedded. To check it, watch the hammers in the piano as you hit three or four adjacent keys around each balance rail glide *staccato* and firmly, but without sounding the notes. If the neighboring hammers bounce, the glide needs to be adjusted down (clockwise). Also, rap the glides with something heavy but soft (I use a rubber handle of a Husky screwdriver) and adjust until slapping or clicking noises stop.
- Is the regulation within reasonable limits? If not, perform it prioritizing the middle section and notes that are out of regulation the most. Letoff, drop, and blow distance determine the acceleration of hammers and sound volume.
- Are the shank screws tight? If not, tighten without changing hammer alignment.
- Resolve any other larger issues, such as hammers rubbing against each other, misaligned wippens causing repetition levers to rub against neighboring knuckles, bobbling hammers, excessively deep backchecking, extra strong repetition springs, jacks binding due to misadjusted repetition levers, etc.

Playing and Listening

To voice a piano, the goal is to decide which notes need attention while maintaining a sense of balance between sections. But when you focus too much on note-to-note evenness, you tend to misjudge how sections relate to each other. Does the tenor section overpower the melody octave? Is the top octave too aggressive or the lower treble too timid? Does the bass section need a boost? Decisions like that require a fresh mind and well-rested ears.

If you allow yourself to listen for small variations in sound — duplex resonances, sizzles, and false beats — all variations will get amplified and you will lose the ability to judge the

effectiveness of your work. While a hammer you just needled may seem dead, another hammer you needled just as much may seem unchanged. When you experience ambiguity like this, it means that your ears are tired, and you should take a break.

Keep your voicing technique simple so that deciding what to do doesn't become the source of ambiguity and fatigue. When you are not burdened by the choice of needling technique, you can focus more easily on determining which notes to needle. As you gain experience, you can listen for more nuance and differentiate between three or four different techniques, but this must not become an impediment that defeats the purpose of your work.

I used to think that the greatest challenge in voicing is hearing everything and knowing how to fix each defect in sound. What I've learned since is that the real challenge is hearing only what you need to hear. You need to listen selectively. This is how you conserve energy, keep fatigue at bay, and prolong your ability to voice a piano. To listen selectively, you need to play patterns that create a musical context in which particular issues are revealed. A few useful patterns are suggested below.

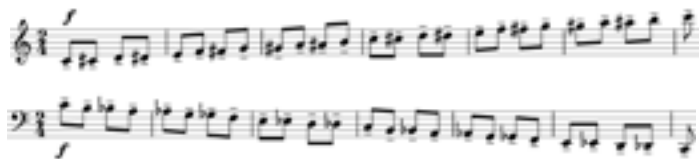
The piano sounds very different in these three configurations:

1. With the lid down, music desk up (the way the piano will be used while reading music)
2. Without music desk and with the lid up (this is the performance configuration)
3. Without the fallboard, with the lid up (this is what you will hear while voicing)

Play your test sequences in configurations 1 and 2 before pulling out the action so that you can compare your observations with what you'll hear during voicing. Remember how much the lid and music desk damp the melody section to avoid over-voicing it!

If you play the piano, first play a few measures from your favorite pieces to get an impression about the sound, evenness between sections, and evenness from note to note. Are there discernible mechanical issues that you should resolve before proceeding? Address all clicks due to loose hammer heads, loose center pins, and other action issues. Is the damper upstop rail adjusted too high, allowing the underlevers and dampers to become sources of distracting key knocks or noises?

If you don't play, test the evenness by playing all notes chromatically up, then down, starting in the middle section, for example at C4.



Example 1: Chromatic test of voicing evenness. Continue playing through the rest of the range.

Then play this pattern to reveal the balance between sections:

Example 2: Simple test in C major for balance between sections.

Also play:

Example 3: Simple test in G major gives another perspective on balance between sections.

If you play, use the expanded versions of the above patterns:

Example 4: Expanded version of the C major test for balance between sections.

Example 5: Expanded version of the G major test for balance between sections.

Bring out the melody in the upper voice. Does it carry equally in each section? Does it stand out against the accompaniment equally in each section?

Since this is maintenance voicing, the piano's current condition, at least in the middle section, can be assumed to be louder and brighter than it was originally, and the original condition can be considered a safe goal. That means that most if not all hammers will be voiced down or needled. Anytime you feel compelled to voice up a section or voice up the entire piano, clear that with the owner, keeping in mind that (s)he may not like the result. Owners tend to get used to the flaws in their pianos and may dislike a change. If the owner is explicitly requesting particular modifications, know that what (s)he is saying may not mean to you what it means to him or her. Also keep in mind that a voicing request may really be about action regulation, lubrication, or even tuning. Sometimes it's about the room acoustics.

Tactfully ask the owner about the state of his or her hearing. Does (s)he wear a hearing aid? Early in my career I

replaced hammers for a customer who was complaining about the sound of her well-kept Steinway grand being "mushy" and not well defined. The piano was mellow, but not unusually so. The hammers were somewhat worn, so I installed denser hammers and voiced them for a round and expressive tone. The piano gained in dynamic range and had a wonderful tonal gradient (*pp* was mellow, *ff* brassy). The customer hated it and had me voice down those hammers until they were ruined, sounding even mellow than the original ones. She complained about particular notes sounding off or too loud and distorted, and this should have been my clue, but I proceeded installing and voicing a second set of hammers. Same problem again.

During a voicing session, she couldn't hear me and complained about the battery in her hearing aid. Next time I was there, apparently after the battery was replaced, she said how wonderful the piano sounded, but it was just so loud. A simple adjustment of the volume on her hearing aid fixed that. Since then I've asked for more information from owners on how they perceive the sound of their pianos, as well as the mechanical response and room acoustics before making any major changes.

There are two ways you can work: Play and mark the needed changes with chalk on the keys, then needle the hammers; or remember five to six notes at a time and immediately needle those hammers. If you are new to this or don't play, I recommend using chalk. You may want to use different marks, for example, circles to indicate notes that need voicing down and triangles for notes that need to be voiced up. The size of the symbol can indicate the extent of the needed adjustment. Wipe the chalk off before each pass. If the chalk remains visible, wipe it off with 90+% alcohol on a piece of cloth.

The main voicing test, which you repeat after each batch of adjustments, is to play chromatic scales *mf* to *f* to reveal notes that stand out (Example 1). Play these scales at a fairly fast tempo and *portato* (each note separately) so they don't blur together. Do not use the damper pedal.

This test, played assertively at the same dynamic level, is enough to go by in most circumstances and will produce satisfying results unless the hammers have been shaped, needled, or hardened very unevenly. For example, if one hammer has hardener only on the shoulders, and another on the crown, the second hammer will need more needling close to the crown. In that case, play the chromatic scale not only in *mf* but also in *pp* and in *ff*. You may need to make adjustments that are outside the scope of this article.

So far, we've been discussing voicing down and voicing up as if there is only one dimension in piano sound: loud and soft. I hinted earlier that the sound quality or sound color should change from mellow in soft dynamics (*pp*) to bright, even brassy, in *ff*. This *tonal gradient* is what makes the piano sound interesting and "orchestral." When you play a melody loudly against a very soft accompaniment, the ear easily connects the notes of the melody, because they produce more upper partials than do the notes of the accompaniment.

With use, piano hammers get compacted and worn, and the tonal gradient gets compressed: A note at *pp* becomes too bright with too much attack noise, and its color starts resembling *ff*, except that it's softer. Aside from evening out the tone, the goal of maintenance voicing should be to expand the tonal gradient so that *pp* becomes mellow again, but without reducing the power and brightness of *ff*.

Fortunately, in most pianos the same technique you use to even out the brightness in *mf* to *f* makes the *pp* equally more mellow. Also, reducing the brightness reduces the overall volume in all dynamic levels. It is feasible to use one technique to voice down most if not all notes that stand out in a piano.

In comprehensive voicing classes, we are taught to check each note on multiple dynamic levels:



Example 6: Test of voicing at different dynamic levels.

This is a good test, but it takes time and is geared more toward establishing a tonal baseline between sections and testing the voicing on sample hammers in a new set of hammers. If you use it, beware of ear fatigue.

A more practical test, especially in the context of maintenance voicing, is to play musically meaningful sequences, such as a melody against a soft accompaniment, to reveal how the notes blend and connect with each other.

The best check to use when ascertaining whether a note stands out is to play it as the second note of a two-note, tension-release melody with a harmonic accompaniment. The simplest form of this is the following chromatic two-voice sequence:



Example 7: Simple pattern for testing evenness. Bring out the right hand.

Play the two-note gestures in the right hand fairly loudly, with the second note in each measure softer than the first, and play the left hand very softly. Don't use the pedal. In this example, all notes in the right hand, except the first one, are played twice — once *mf* and then softer, perhaps *p*. If the second note in each measure stands out as too bright and aggressive, you will know you need to voice it down. If the first note in each measure is too weak, you will need to voice it up. And when a note stands out both when played as the second note in one measure and first note in the next measure, it should receive extra needling.

A slightly modified version of the above pattern involves increasing the tension on the downbeat. This enhances the contrast between the first and second notes in each measure:



Example 8: Modified simple pattern for testing evenness with greater tension on downbeat. Bring out the right hand.

If you play proficiently, consider using the expanded version of the above patterns, which mimics the music of late Romantic composers:



Example 9: Expanded pattern for revealing notes that stand out in the upper voice. Play without, then with pedal.

Don't feel you need to adhere to these exact patterns. Modify them with different harmonic progressions and add leaps and melodic excursions. In other words, improvise to create musically rewarding situations. This is the best way to keep ear fatigue at bay and remember the notes you need to change. Adding musical context to your patterns will greatly improve your workflow.

Focusing on the evenness of adjacent notes is extremely important but doesn't reveal anything about the balance between the sections. I play the section-balance pattern (see above) to quickly compare the four octaves between the tenor and treble.

I'll transpose this to other keys, major and minor, which reveals not only sectional discrepancies but also individual notes that stand out. I also like to play this pattern to find out whether the tenor section is disproportionately loud (or boomy) compared to the middle section.



Example 10: Test for balance between tenor and middle sections in C major.

Play it in other keys, for example C-sharp major:



Example 11: Test for balance between tenor and middle sections in C# major.

In general, you should play while sitting and frequently compare to playing while standing. When in doubt, move your head left and right. Some seemingly bright notes will blend in and others will stand out. Ignore room and lid resonances (boominess) and focus on the piano's sound. If feasible, move the piano to a different location within the room. Of course, ultimately it needs to sound balanced and even in its usual place.

Voicing Down

For maintenance voicing, I recommend deep needling the upper shoulders and shallower needling toward the crown. This technique expands the dynamic gradient, making *pp* mellow without compromising power and projection in *ff*. To some extent the tone will also gain in sustain and bloom, which most pianists consider highly desirable. Unlike felt manipulations that focus on the crown, such as "sugarcoating" or the chopstick voicing described below, this technique will produce lasting results and the voicing will change evenly over time. After a few weeks of playing, the tone will brighten somewhat, but its basic character will remain unchanged even if the hammers are reshaped later. Techniques that manipulate the felt directly on the hammer's crown don't last.

If you are working on a cheap piano or a piano with extremely hard hammers and you want quick results, instead of needling the hammers, you may consider using one of the alternative techniques explained below.

I'll step out on a limb and say that for maintenance voicing, it is OK if the hammers in the middle and upper bass section have grooves up to 10 mm long. Grooves certainly aren't desired, and make the tone harsh, percussive, and noisy, but remember that the alternative is removing mass from the hammers and ending up with a weaker and more nasal sound.



Grooves up to 10 mm in length can be acceptable for maintenance voicing.

If you are open to experimenting, you can compensate for the lost mass when sanding the hammers by putting small binder clips on hammer shanks (or permanently adding mass by installing lead wire in hammer moldings) per David Stanwood's protocol, but the tone may still be weak, yet muffled. If the attack is not too noisy and the overall tone is bright and aggressive but fundamentally satisfying, leaving the hammers unshaped or partially reshaped can be better than completely removing the grooves.

If the grooves are longer than 10 mm, reshape the hammers first, but leave short grooves in place. This will help you maintain good hammer-to-string mating. A good indicator of hammer mating is when all three remaining grooves are the same length and run in a straight line perpendicular to the hammer.

The needling in this technique expands the upper shoulders and gives grooved hammers a slight inverted pear shape. The shape can be corrected by sanding and ironing (explained at the end), but by itself this blunt shape is not a problem when the target voicing is relatively mellow.

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Reshaping the hammers after needling is typically not necessary unless you want the tone to be particularly clean. If you do reshape the hammers, you will need to make another pass of light needling.

Needling Procedure

For a grand piano, place the fallboard on the floor on the inside of the right leg, and place your tools on the piano.



Tools for maintenance voicing.

For a vertical piano, open the lid and remove the top panel and the mute rail. The rest of the instructions are for the grand piano unless stated otherwise.

You should voice, then play and listen, in cycles of 4-6 notes at first, expanding the cycles to more notes as you gain experience.

You can use one of two strategies: First, even out the bass section, which is arguably more forgiving (I tend to do that), or, if the inherently uneven noisiness in the bass confuses you, start by “trimming down” the loudest notes in the middle and tenor sections.

The summary of a cycle of the voice-down (needling) procedure in grands is:

1. Play within two or three octaves and remember or mark four to six notes that need work.
2. Remove the end blocks.
3. Pull the action onto your lap.
4. Place the hammer support block under the hammers.
5. Needle the hammers in question. (Push the needle smoothly, don't stab the felt.)
6. Reset the felt by pounding it with the back of the voicing tool.
7. Remove the hammer support block.
8. Re-insert the action.
9. Align the action with front-rail position marks or put in the end blocks and press and release the soft pedal a couple of times.
10. Test by playing within the section on which you were working.

Repeat this as many times as necessary. For final checks, always put in the end blocks and test with the fallboard installed, then with the music desk up and lid down.

In a vertical piano, support each hammer with one hand and insert the needle with the other. You can't effectively support the hammers, nor can you pound the felt, but use the handle of the voicing tool to press the felt between 11:00 and 1:00 relative to the crown. That will reset the felt sufficiently and prevent the tone from bouncing back too much.

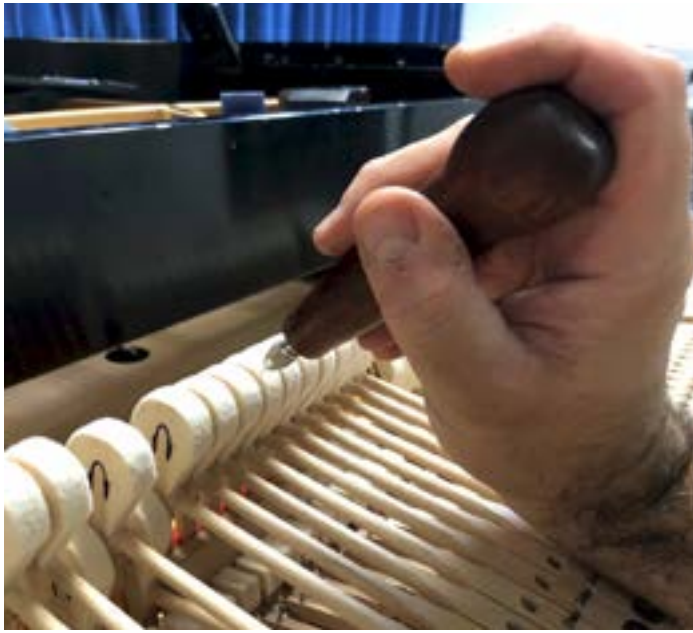
Pushing a needle into dense felt is hard on the hand, wrist, and the whole arm and shoulder, and it can lead to repetitive stress injury. Be aware of how each hand position feels and learn to hold the tool without discomfort. Be especially careful how you hold the hand when needling the fore (front) shoulders in grands to avoid a carpal tunnel injury. I tend to alternate between the two positions in photos shown below.



My technique for needling the aft (rear) shoulders.



One position for needling fore shoulders.



Another position for needling fore shoulders.

Needling the hammers is a one-way street: Though the tone can be brought up to some extent by pounding the key and by pounding and ironing the felt, the loss of density and tension in the hammer felt is permanent. Hardeners can help, but the tone will have a different quality. Needle less during each pass until you gain experience and confidence.

Voice down the most aggressive notes in the first few passes, then work more systematically, section by section. Prioritize as if you will be asked to leave the room at any moment. That way you will be able to stop, and the piano will be relatively well-balanced and usable.

Set the timer to 30 minutes and stop. Rest before continuing or plan to do more in another session. You will tire quickly at first. When fatigued, everything will seem more uneven, you will hear more partials and noises and will lose a sense of tonal balance. Two sure-fire indicators of fatigue are forgetting which notes to voice and making mistakes. The classic one is breaking the end shanks by inadvertently pressing the end keys while pulling out the grand action. Stop before inflicting irreversible damage to the hammers and shanks, and possibly injuring yourself. (Needles draw blood!)

Maintain a sense of balance between the sections. Is the melody area (F5 to A6) sufficiently present without too much attack noise? In heavily used pianos, the tenor and middle sections, up to F#5, usually need voicing down.

Support the hammers in groups, with a support block resting on the

keys. If wippens have helper springs in the back, be sure not to damage them with the support block.



Hammer support block.

Hold each hammer firmly when needling. If a needle breaks, immediately pull it out by gently grabbing it with center pin cutters. Not extracting a broken needle exposes new voicing needles to damage if they hit the buried needle.

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How to Work

In a grand piano, mark the keybed at the front of the keyframe on each end with pencil or tape so that you don't have to reinsert the end blocks each time.



The front rail position marked on the keybed with a pen.



Front rail position marked on the keybed using painter's tape.

In a vertical piano, simply reach in. You can even voice a few notes without removing the top panel. Use a voicing tool with an angled head.

Work on 4-6 notes at a time, reinsert the action, align it with the marks on the keybed, and play those and surrounding notes in chromatic patterns with *mf-f* strikes.

Either mark the keys of the notes that stand out with chalk (wipe clean when done) or simply remember the notes on which you will work as part of harmonic patterns that make sense to you. (For example, E-G-B-C-E is the E-minor chord with the C added; G-G#-A-A#-D is the G-minor chord with two extra chromatic notes; F-A-A#-B-C can be seen as the F-major chord with extra notes, etc.)

My favorite tool for grands is a single-needle tool by Boaz Kirschenbaum, RPT (pianotuner@gmail.com). This is essentially a quality pin vise in a hardwood handle. It is light and just the right size for my hand.



Single-needle voicing tool by Boaz Kirschenbaum, RPT.

The other options are a single-needle tool (Pianotek Supply item VT-1P or Pianoforte Supply item 130101) or, in a pinch, a large pin vise (Pianotek Supply item PV-93). You can use a standard three-needle voicing tool but may need to widen the needle hole to accommodate a #2 needle.

For vertical pianos I recommend a tool that allows adjusting the head in an angled position. The one on the left is available from Schaff (item 105). The middle one is from Jahn, and the one on the right is an old Hale tool (my favorite because it's small and light).



Voicing tools for vertical pianos.

Place a #2 or #5 needle so it sticks out 8-10 mm. I prefer the relatively thick #2 needles because they

provide results faster and don't break as much as the thinner ones. You can also use one or two #5 needles in a three-needle tool. German #2 needles are available from Pianoforte Supply (pianofortesupply.com) and #5 from Pianotek Supply (pianoteksupply.com/store/results.aspx?search=needle). Do not use glover's needles!

Needle the hammer radially on both sides of the crown in five columns, two or three rows, in areas 11:00-11:45, 12:15-1:00, deeply farther from the crown, shallowly near the crown.



Where and how deeply to needle upper shoulders.

If you see needle holes, probe the felt and aim the needle at its densest areas. If the felt looks untouched, offset the middle row slightly so its holes fall between the holes in the rows above and below it. The spacing needn't be perfect, but you should spread the stabs evenly within the band you are needling. Always needle starting on the shoulder (deeply) and proceeding toward crown (shallowly).

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Suggested positions and depths of needle stabs in grand pianos.



Suggested positions and depths of needle stabs in vertical pianos.



First pass: Establish a rhythm as you needle up from the shoulder toward the crown along the imaginary columns — deep, less deep, shallow; deep, less deep, shallow, etc. Or needle row by row, deep, deep, deep, deep, deep farthest from the crown; somewhat less deep five times closer to the crown; and finally, shallow five times closest to the crown.

Subsequent passes: Probe the surface of the felt and needle where it is dense. The advantage of using a single needle is that you can feel the density of the felt on each stab. This allows you to be more consistent, as 15 stabs in dense areas will have much greater effect than 15 stabs in previous stab holes.

Do not over-needle a narrow band of felt while leaving the areas below and above it untouched, because this will weaken the felt. You should always needle a fairly wide band. Spread the stabs as evenly as you can. Whenever you needle close to the edge of the hammer, angle the needle inward to avoid breaking through the felt.

Perform final checks with end blocks in place. When you've done the bulk of the work, put the fallboard in place and compare. Then compare the sound with the lid down and music desk up. I always get surprised by how much this changes the balance and evenness.

Always reset the felt after needling by pounding the hammer with the back of the voicing tool in the 11:00-11:30 and 12:30-1:00 direction. Pound with force, but be careful not to break the shank.



Resetting the felt by pounding it with the back of the voicing tool.

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Needling Tips

- **Overshoot.** As you follow up on your voicing jobs, you will quickly learn that you need to over-needle the hammers by 10-15%. The brilliance and impact noise return with playing. Ideally, each piano you voice should be subjected to a few thousand strikes on an automated pounder, but that's only feasible in a factory or shop environment. We have to anticipate the increase in brilliance — greatest in the tenor and middle — by voicing those sections slightly mellower than the rest of the piano.
- **Over-needling.** If you slightly over-needle a hammer, mute the strings with a finger, stand up, and pound the key heavily 40-50 times. Repeat if necessary. If the tone is still too mellow or weak, you should voice up that hammer. With dense hammers, lightly sand the hammer, which tends to restore both the brightness and volume of the note. Soft hammers that have been treated with a hardener typically don't react to the sanding, but instead should have a hardener applied. Based on where and how much you needled that hammer and how the felt behaves under the needles, decide whether you need more brilliance and power (firmer upper shoulders), or more projection (firmer felt under the crown). Brilliance and power are restored by applying a normal hardener solution (1:3 or 1:4 lacquer) to the shoulders, and projection is improved with a hardener applied thoroughly and deeply from both sides of the hammer, above its molding. These techniques are described below. You can restore the attack noise with a few drops of highly diluted lacquer (1:12 or 1:16) or acrylic hardener, but this is usually needed only when you've needled the crown directly. Also effective in previously hardened soft hammers can be wetting the crowns with pure acetone. This dilutes and wicks some of the hardener toward the surface, increasing the attack noise and brilliance.
- **Fuzzy and weak sound.** Check the mating of the hammer to the strings. Square and align the hammer if needed, then sand lightly to mate.
- **Clanks and sizzles.** To voice out a clank in the bass, sizzle in the middle, or a duplex sizzle in the capo sections, needle only on the fore (toward player) side of the crown.
- **Loud and boomy notes.** To voice out a loud but not bright note, extend the needle to 12-14 mm from the tool and needle horizontally from upper shoulders (on both sides of the crown), aiming at the area of felt 1/3 to 2/3 of the way down under the crown. The closer to the crown you insert the needle, the more you will affect the volume in *mp* and *mf*; farther

from the crown, you will change the volume in *f* and *ff*. Make a row of five deep insertions from each shoulder and repeat up to two times at different heights. This is difficult to undo — make sure you are doing this for the right reason and not to compensate for a room resonance.



Voicing loud and boomy notes.

Alternatives to Needling

In many Asian and some European pianos, the hammers are so dense that needling them is almost impossible. If replacing the hammers is not an option, you can do one of the following:

- Apply a hammer softener such as Pianotek Supply's item #THS on the shoulders or over the entire top of the hammer. Test on the densest hammers first. I don't recommend applying fabric softener and lubricants such as VS Profelt. They work, but they limit your options later.
- Apply a 50% alcohol (mix a 90%+ alcohol with warm water about 1:1) to the tops of hammers. Avoid getting this solution on the lower shoulders or felt tips because it could weaken the glue and destroy the hammers. In most cheap hammers, staples won't prevent the felt from coming apart from the molding!
- Steam the felt. You can use a fabric steamer or place strips of wet cloth on the shoulders and apply a hot iron to them. This can be very effective but is hard to control and can cause the felt to bulge or come apart.
- Soften the surface layers of felt on the crown and upper shoulders by pressing the hammers with a steel file card. This will instantly improve the tone, but the harshness will return after a few hours of playing.

These techniques can be used to restore worn hammers in old pianos, but remember that their glue joints are vulnerable. Avoid water and steam.

Voicing Up

- **Sanding.** To voice up a note, sand the felt (effective on dense hammers) or apply a hardener solution. Keep in mind that sanding a hammer makes the sound brighter and increases attack noise, but it also makes the tone more nasal and lightens the touchweight.
- **Hardener.** For low-density hammers such as those in New York-made Steinway & Sons pianos, the recommended hardener is nitrocellulose lacquer (with c. 10% solids) diluted in a 1:3 or 1:4 solution with lacquer thinner or acetone. (I prefer acetone.) High-density hammers that need to be voiced up can also be treated with a lacquer solution. You might consider using a hybrid acrylic/nitrocellulose lacquer or an acetone solution of acrylic or B-72 pellets instead. B-72 has been popularized recently by Dale Erwin and Ken Eschete.
- **Hardener on shoulders.** Steinway in New York recommends applying the hardener to the shoulders to increase power and brightness.



Increasing power and brightness by applying a lacquer solution to the shoulders.

This technique works well on very soft hammers but will reduce the sustain and tonal gradient on denser or already over-lacquered hammers. One feature of this technique is that the felt will wick the hardener past the point at which you apply it, so you have to be careful with how much of it you want to end up on the crown. Apply the hardener by laying the applicator needle on the middle of the shoulder and slowly and thoroughly flood it until the entire shoulder becomes wet. Move the needle if necessary and stop when the liquid reaches a few millimeters below the crown. Repeat on the other shoulder. Avoid applying the hardener close to or directly onto the crown (or the grooves), because it will cause ugly and uneven attack noises that will be difficult to voice out.

- **Hardener on the crown.** If the hammers are very soft, apply a 1:16 or 1:12 lacquer solution to the crown. An

alternative for previously lacquered hammers is to apply pure acetone to the crown. This will dilute some of the hardener that's already in the hammer and pull it toward the surface, adding attack noise and increasing power to some degree. To increase attack noise, some technicians apply a few drops of an acrylic or B-72 solution directly to the grooves on the crown. Others recommend brushing it with a small nail polish brush. While quite effective in a concert prep environment, these techniques are not permanent enough to be recommended for maintenance voicing.

- **Hardener on the sides.** To increase the sound projection and volume, apply the hardener above the molding from both sides of the hammer.



Increasing projection and volume in a hammer with dense felt.



Increasing projection and volume in a hammer with softer felt.

Keep the applicator needle in contact with the felt and slowly flood the surface to get as much liquid as possible into the felt and not spread on the surface. The idea is to apply the liquid throughout the width of the hammer. The closer to the crown you apply the hardener, the more it will affect the brightness of sound. Apply the hardener a bit less close to the crown on the left side of the hammer to avoid having shift-related zings with the soft pedal.

Soft-Pedal Voicing

Play chromatically and perform other checks with the soft pedal depressed fully, then depressed halfway.

Adjust the shift stop screw for greatest change in timbre without zinginess and nasal quality.



Adjusting the soft pedal shift stop screw.

With the soft pedal fully depressed, the hammers should shift so they hit the strings 1/2 to 2/3 of the distance toward the grooves to the left. Voice for soft pedal by needling the left edge of the hammer and on the areas between grooves at 11:00 - 11:55, always needling shallower toward the crown. You may want to use a thinner needle for this, especially if you need to work much directly on the crown.



Voicing for soft pedal.

Final Tests

- Play chromatic sequences and musical patterns as shown above. Loud and noisy notes stand out more readily when played as releases in a musical context.
- Play a melody against broken chords or other soft accompaniment: melody on top, melody in the middle, played with thumbs. How is the balance?
- Using the pedal reveals the overall sweetness and cleanness of the tuning and effectiveness of the gradient in voicing: The brighter, louder notes are amplified and enhanced by the upper register and duplex resonances. Remember, the upper octave and a half don't have dampers and resonate even when the pedal is not used. When well tuned, that section enhances the sound of the whole piano.
- Compare your playing with and without the soft pedal depressed. Is there enough effect? Is half-pedaling acceptable tonally? Is the tone zingy with the pedal? Correct as needed, or consider adjusting the shift stop screw.

Bedding and Shift

When tightening the end blocks, always keep pressing and releasing the soft pedal to observe whether the return slows down. If so, shim the blocks or, if in a hurry, leave the end block screws not completely tight. Test the ends of the keyframe for knocking by loosely pressing down the bottom and top keys (with minimal force) and pounding them. If knocking is evident, cut off a layer of the fiberboard shim on the underside of the end block or, if in a hurry, shim the end(s) of the front rail with pieces of business card or file folder material.

If Time Permits

Lightly sand the surfaces of hammer shoulders toward crown with 320, then 600 sandpaper. I recommend sanding individually. Avoid sanding the crown, do not distort the shape of the hammer, and do not cut through the layers of felt.

Round (bevel) the left edge of each hammer with a 320-grit sandpaper paddle. If you have time, round the right edge as well. Start at around 2:00 and sand with light strokes to 11:30, then sand from 10:00 to 12:30. This will give the *pp* extra warmth and enhance the contrast when using the soft pedal.

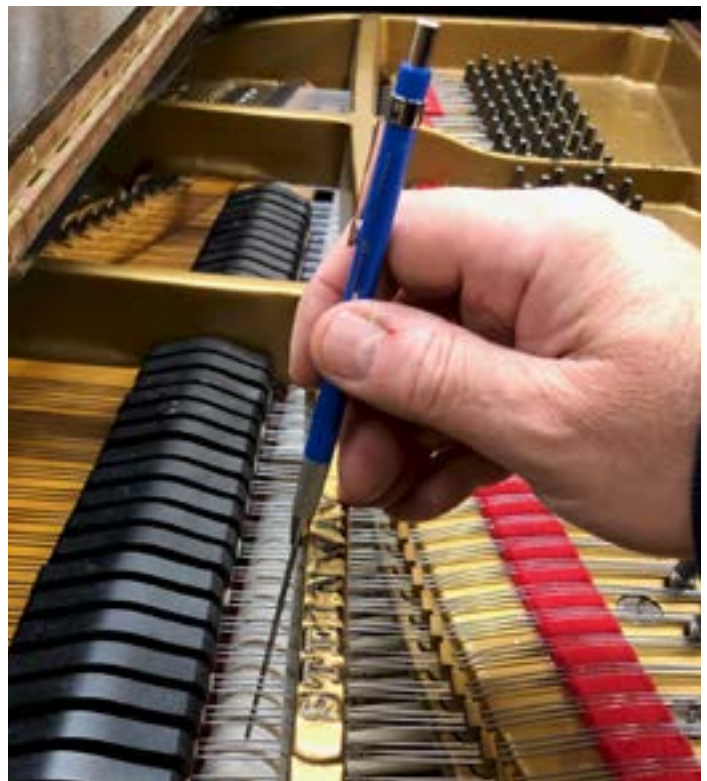
Obtain a traveling iron with a smooth surface and with few or no steam holes, such as the one depicted here that's currently available from Walmart (tinyurl.com/rtct7w6). Warm the iron to 155° F or 68° C (medium or wool setting) and iron the shoulders with moderate pressure and small circular movements. Iron the shoulders of angled hammers one hammer at a time, maintaining the angle of the felt surface. Make quick passes (still with circular movements) over the crown with less pressure. Lightly iron the edges you beveled at a 45-degree angle to the hammer. The ironing will slightly increase the brightness and improve the focus and definition of the tone. However, the effects may not last, especially if humidity rises.



Small travel iron suitable for ironing the hammers.

Small Final Adjustments

For small voice-down adjustments after you've reassembled the piano, needle the hammer with a chopstick tool inserted between the strings and dampers.



Needling the upper front shoulder with a chopstick voicer.

There are several styles of chopstick voicing tools. You can make one by drilling a hole in the tip of a bamboo chopstick, hardwood dowel, or a piece of brass stock, and gluing a needle into it. Thin the chopstick to fit between the strings. The tool depicted here is a Staedtler Mars technical pencil with a thin

metal shaft as “lead” equipped with a needle on one end. The metal shaft can be stored reversed and retracted into the pencil, protecting the needle. The tool can be purchased from pianofortesupply.com (item #130210).



Retractable chopstick voicing tool.

To voice with the chopstick voicer, play the note *ff* so the hammer is checked firmly. Then, while holding the key firmly depressed, push the hammer as far down as it will go with the chopstick voicer needle. Now needle in the upper shoulder area of the front of the hammer and lightly on the crown. It is unfortunate that you can't reach the back shoulder between the dampers at the same angle as the front, so this technique works more like reducing the clank or V-bar noise than conventional needling on both sides of the crown.

Conclusion

There is no need to shy away from voicing a moderately worn piano in reasonably good condition. Maintenance voicing, accompanied by some lubrication and highest-priority regulation procedures, will provide greater value than always systematically addressing every aspect of the piano's regulation, string leveling, and hammer shaping and mating. In an ideal world every piano would be given as much attention as it really needs, but when time and resources are limited, it's worth prioritizing maintenance voicing over other procedures. ■

Music examples typeset by Seni Igréc, DMA, NCTM.

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