Fine Tuning the Harpsichord **Fred Sturm**
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I. Laying the Foundation: Free and solid movement

A. Keys must move freely on their pins, but not be wobbly/clattery. In general, keys should "float" to rest position with jacks removed.

1. Friction at balance pin most commonly means wood fibers within the mortise are impeding free movement. A jewelers file, with two parallel sides that come to a point, is the best tool to correct this problem. Bear on the tip of the file, keeping pressure away from the top of the mortise to avoid over easing. An appropriate size (very precise) drill bit in a pin vise is another useful tool.

2. Friction at the back pin where a pin protruding from the back of the key rides in a wooden slot. This can usually be corrected by removing the key and running a screwdriver blade or pencil lead in the slot.

3. Too loose at the balance pin can be corrected by adding "key buttons" made of square shanked toothpicks or something similar.

4. Too loose at the back pin can be corrected by replacing the pin with a larger size (standard piano centerpins are commonly used).

B. Jacks must slide in upper and lower guides with no friction, but if too loose, they may not repeat reliably.

1. Tightness in upper guide may be relieved using a file, very carefully. A rectangular mill file of appropriate thickness is recommended. Check first by "wobbling the jack in every direction" to determine where it is tight. Sometimes the jack itself will have a bulge, usually by the tongue pin. File/sand to correct.

2. Tightness in lower guide: this is pretty rare. More commonly there may be too sharp an angle between upper and lower guides, which is a complex problem to solve, beyond the scope of this class. It involves shifting the lower guide, but that needs to be done with reference to the backs of the keys and the strings, and can involve the need to re-pin the nut. On an individual basis, the upper guide can be "relieved at an angle."

3. Looseness in upper guide can be corrected by adding shims to the top of the guide, or by applying self-sticking glossy paper strips to the jack. Decide which way you want to move the jack - closer to the string or farther away – based on consistent plectrum length.

C. Tongues must return freely to rest position

1. Weak return springs are the most frequent culprit. Most are delrin plastic , and are part of the tongue molding. If they are weak and are not returning the jack rapidly all the way, put a positive bend in the spring, away from the point where it attaches to the tongue body. It is generally necessary to back off the top adjusting screw to do this.

2. Misalignment of the tongue can result in rubbing against the side of the jack body. Correction depends on design.

3. Friction in the hinge pins. Many tongues have protruding pins which snap into holes in the jack body. Over time, friction can develop between plastic and plastic. I have not found a reliable solution (have tried lubricants like Protek or powdered teflon, drilling out the hole slightly, working parts together vigorously, with moderate success).

D. Plectra must slide freely past strings

1. The most common problem is a burr at the end of the plectrum, which can be removed by cutting straight down. Check for this by letting up slowly on each key in turn, allowing each plectrum to rest on its string. Then make sure it slides quickly and positively past the string, with no hang-up. Note that a damper set too low, or a jack bottom screw set too long can produce similar symptoms.

II. Regulation and Voicing (inseparable: one affects the other)

A. Plectrum lengths should be as consistent as possible within each register.

1. Ghosting: When doing major voicing, first adjust the register to a point in between on and off, so that as many plectra as possible are just brushing (ghosting) their strings. Then adjust (using top adjustment screws) or trim or replace plectra as needed so that all plectra ghost their strings. (A similar procedure is used when re-quilling: set the register, then cut all plectra to length so that they ghost).

B. Plectrum underhang should be even: all plectra should underhang their strings by the same amount, something on the order of half the thickness of the wire.

1. If you have ghosted evenness of underhang will not be a problem. Simply adjust the stop for the register (usually a capstan screw) to an appropriate distance.

C. Adjust register on and off positions. As mentioned above, the on position will place the underhang at the appropriate distance. The off position is equally important, especially to damper regulation. Off should be as short a distance from on as possible, while ensuring that no jacks will sound. If all plectra have been ghosted, this distance can be minimized.

D. Voicing evenness

1. Even widths. Plectra should be narrowed to consistent widths, possibly tapering somewhat from bass to treble.

2. Even resistance = even volume. Making a harpsichord sound even and feel even are intimately inter-related. The resistance felt by the finger is both a good gauge of how loud the note will sound, and the most apparent aspect for the performer. The bottom of the plectrum should be thinned to obtain a volume and resistance that are even and appropriate. In general, 75 – 125 grams placed on a key should cause a full pluck,

though tastes may vary from these parameters. Using weight is a good way to check one's aural and finger sensitivity. One may measure by placing the weight on the key at rest position (supporting it with a finger), and allowing it to drop; or by resting the weight on the key at pluck point. The latter will require heavier weight. Both methods are useful, though the latter is probably more precise.

3. Thinning the bottom of the plectrum is done most efficiently and with fine control by first trimming shavings from each corner, then shaving a very thin quantity from the bottom. Use a slight slicing motion to avoid chatter of the blade. Take care to start trimming very close to the tongue (use the very tip of a #11 scalpel blade).

E. Plucking point evenness. There should be a small amount of keydip before the plectrum contacts the string. Otherwise, the plectrum won't return, it will jangle on the string, and damping will be impossible. The "lost motion" before the plectrum touches the string should be even for each register. The point at which the plectrum contacts the string is called the plucking point.

1. Plucking point should be set as close to the string as possible for the first register to pluck (see staggering below). One way of doing this, assuming the jacks have bottom adjustment screws, is to adjust so that the plectra are touching the strings at rest, then turn the screws in a standard number of turns.

E. Staggering. If more than one jack is activated by each key, the plucking points should be staggered so that one follows the other. In general, the plucking order will be (1) four foot, (2) front eight foot, (3) back eight foot, (4) sixteen foot (these are rare). However, often a double manual will have a sequence of (1) four foot, (2) back eight foot, (3) front eight foot (always activated directly by the upper keyboard). In this case, it is well to have a small and even amount of lost motion between the doglegs and the bottom of the upper keys, so that the plucking point of the upper keyboard, when played alone, will not be too low.

1. After setting the plucking point of the first register, staggering is simply a matter of adjusting the plucking point of each additional register in turn. Depress each key in turn very slowly, and adjust so that it is possible to pluck each string in turn in a controlled manner. It is necessary to pay attention to the available keydip (usually controlled by the jacks hitting the jack rail). The last jack's pluck must not be too late in the key dip (there should be "aftertouch.") This can be especially problematic in the bass, because bass strings move more before plucking, hence more keydip is required per pluck.

2. When there are no adjusting screws, adjustment is made by filling the bottom of each jack. Reversing is troublesome if plucking point is adjusted too low. Small squares (or rectangles, depending on the jack's profile) of paper or cardstock can be glued to the bottoms. I use self-stick paper. I strongly prefer jacks with adjustment screws, as plucking points will change in response to humidity change.

3. Note that staggering will be affected by voicing. The stiffer the voicing of a given plectrum, the more keydip will be required to achieve pluck. The same is true for the amount of pletrum underhanging the string. It is essential that ghosting, adjustment of the register on position, and voicing be complete before staggering. Having said that, when one is "touching up an instrument," one may not go through all the steps, but you should be aware of how each will affect the other. For example, if there isn't enough keydip to allow for good staggering of three jacks, probably the underhang should be reduced and/or the stiffness of the voicing should be reduced.

4. Weight required to pluck should not be much more for a fully coupled harpsichord as for a single register played alone – perhaps 30 additional grams at most. If it requires substantially more weight, staggering distances are too close. (Some harpsichordists like a very shallow keydip, which means some compromise may be necessary).

III. Dampers

A. Material. Generally, extra quality key bushing felt or the equivalent is the best choice for jacks where damper felt is inserted in a slot in the jack body (there are alternate designs which use a butt felt style).

1. The felt should be firm and should have a smooth surface against the string. When registers are turned on and off, the damper slides perpendicular to the string. Old damper felt tends to develop indentations, or to curl. Extra quality bushing lasts longest and functions best.

B. Placement.

1. The felt should extend slightly beyond the end of the plectrum. It is necessary that the damper should be in contact with the string when the register is turned off: in contact and still resting on the string. However, the felt mustn't extend so far that it damps the next string. This is a very fine adjustment, and quality scissors (the same ones you use for piano damper work) are a must. Alternately, one can use a sharp razor blade and a block to trim if necessary.

2. The bottom of the felt should be enough above the top of the plectrum to allow the plectrum to get under the string reliably (and not jangle on the string), but should be low enough so that the jack is actually hanging slightly by the felt. Note that it also needs to be exactly perpendicular to the jack, so that the damper will function well when the register is turned off (to avoid sympathetic vibrations).

C. Four foot dampers are particularly problematic. They must extend far enough to damp both when the register is on and when it is off, but must be short enough that it doesn't contact (and damp) the eight foot string above it when at full key dip. Generally these felts are cut at an angle, with a tiny point contacting the string. If the nuts were not pinned accurately or consistently, it can be impossible

to achieve all the desired specifications. Many instruments omit dampers on the top octave or two of the four foot, for reasons similar to the piano.

D. Installation. To install new damper felt, take a strip of felt of appropriate width, and pull it into the slot. Looking at the jack from the side, note how far the felt is above the plectrum, and how much it extends beyond the end of the plectrum. When it seems correct, slice the remainder of the strip along the back edge of the slot. To adjust further, use a slim screwdriver blade to push the felt farther down in the slot. Other fine adjustments are done with fingers and by trimming (err on the side of very slightly too long).

IV. Keydip is usually controlled by the jack rail. Some instruments have a means of adjusting the rail up or down. In others, it is fixed.

A. Felt can be added to the jack rail, possibly by threading it beneath existing layers (which are often tacked on with carpet tacks) to reduce keydip. It is also possible to add felt at the back rail, but this is very cumbersome and involves removing all jacks and re-staggering.

B. The tops of the jacks can be trimmed to increase keydip if necessary. This is best done using a jig and a bandsaw.

C. In most cases, it is best to leave keydip alone and make it work. Note that raising or lowering key level will have next to no affect, as it is the distance between the back of the key and the jack rail that matters.

V. Troubleshooting

A. Damper bleed. Solved usually by adjusting the damper downward in its slot. But be sure this allows the plectrum to get under the string on return. Sometimes the jack's bottom screw will need to be adjusted (or bottom trimmed in the absence of a screw) to allow for both good damping and repetition (especially likely if the instrument has gone from humid to dry climate).

B. Inconsistent repetition

1. Check for free movement of key: remove jacks for that key. See that it returns on its own. NB, many "float" slowly to rest position.

2. See that jack is not hanging on guide, or on a guide support. Sometimes a jack will have a burr, or a small bulge where the tongue pin goes through it, causing a bind. File to remove.

3. Check if the jack is held too high by the key. Play the note and slowly let up on the key. Does the jack follow the movement of the key all the way? Is the plectrum still not below the strin? If so, adjust the jack's bottom screw or file. Or, possibly, trim the length of the plectrum (if it is obviously protruding under the string more than its neighbors).

4. Does the plectrum itself hang on the string? Test as above. If the plectrum is stopped on the string while the key continues to move, there may be roughness or a burr on the underside of the plectrum (very common). Use scalpel to correct.

5. It is possible the damper is adjusted too low, not allowing the jack to descend far enough.

6. Tongue spring not strong enough. Remove jack, see that tongue "snaps back" to place. To correct (most designs with plastic spring as part of tongue), remove tongue and increase the bend in the middle of the spring. Sometimes the top adjustment screw must be backed out to allow for tongue removal.

7. On some designs, the tongue can be misaligned, rubbing the side of the mortise.

C. Miscellany

1. Dampers overhanging too far, partially damping the neighboring string (usually noticed while tuning: a "fuzzy" sounding note). Trim or adjust in slot to correct.

2. "Weak note" - plectrum could be failing or could be sliding out of its slot. On Zuckermann, jack spring could be weak and ready to break.