Replacing Grand Action Parts

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Portland Convention
3/13/2008

SHANKS & FLANGES:

- **Centerpin:** most all measurements can be referenced from the center of the centerpin
- **Centerpin to center of knuckle:** varying this distance by 1 mm will affect down weight at the key by +/-5 grams.
- **Center of centerpin to center of drop-screw:** This specification will determine where drop screw will land on the end of the whippen repetition. In reality, as long as more than half of the bottom of the sdrew lands on the repetition pad, it should do its job of stopping repetition.
- **Centerpin height:** the placement of the centerpin in relation to the action rail. This can effect bore distance needed on the hammer and effect let-off and drop.
- **Center of screw hole to back of the flange:** The back of the flange in most cases should fit tightly against the lip at the back of the flange rail. The back of the flange may be straight, angled or notched to accomplish this.
- **Width of the shank:** standard shanks are 12mm wide. Some old shanks are narrowed for clearance on tight scales down to 11 mm. This 1mm times 88 ads up to 88mm or 3.5 inches over the length of the action. Tapered shanks bend and spring the hammer back off the string quickly. This energy produces increased ring time. A stiff shank and tail will create more of a zing.
- **Knuckle Diameter:** the measurement is not the diameter of the knuckle, but the distance the knuckle extends down from the bottom of the flange. 9,10 or 11mm.
- **Depth of the counter-sink at the screw hole**: if you are re-using the original screws, this depth will effect how well the screw will grab or if it goes down too deep, it could possibly split the flange rail. If the screw goes into the rail too deep, it could split the rail.
- **How many shanks are tapered**: tapered or non-tapered shanks have an effect on tone and weight.

WHIPPENS: Things to consider when changing maple whippens on non-Steinway and Mason & Hamlin actions.

- **Length of measurement from the jack center to the flange center:** This can effect placement of the knjuckle and leverage of whippen as well as the placement of the top of the jack in the window. The jack angle of a Steinway is about 5mm lower and is more of a right angle.
- **Centerpin height at the flange:** this center can be 4mm higher on some whippens. The length of the flange from the screw hole to centerpin can sometimes adjust this.
- **Length of heel:** How much will this affect the height of the capstan?

- **Heel placement:** as long as more than one half of the capstan will stay on the heel pad, this will not affect the leverage. Pin jig for heel placement on a drill press has set stops for placing the whippenin adjustable positions.
- **Jack tender height:** check to see that you can use the original let-off buttons or modify with larger buttons or move rail. Sometimes new jacks are longer or shorter than the originals.
- **Hammer rests:** do the original whippens have an individual hammer rest built into each whippen, or will you need to make a hammer rest rail?
- **Weight:** the weight of the whippen may not affect the down-weight but may affect the feel of the action considerably.
- **Back action replacement kit:** Steinway makes their parts different from everyone else.

BACKCHECKS:

- Replacing the leather does not always solve the problem. The most important thing that controls the stiffness of the leather is the stiffness of the underfelt. If it is too soft it skids, if it is too hard it bounces.
- The wires must have movement and not be brittle or stiff so the hammer won't bounce. The wire causes the trap. Check the length of the wire so that it doesn't do down all the way through the key and split it.
- Take the length of #1 bass hammer and the top bass hammer, there is an eight of an inch difference in the length. From the first tenor to note 88 there is another eight of an inch change in the length of the hammer to the tail. Find out how high the back checks are before removing them.
- To remove a backcheck, use a ¾" dowel as a fulcrum, and rock a pair of vice grips to pull the wire out of the wood.
- To place the new wires in, dip the wire into Tightbond to size the hole. Tap the backcheck and wire into the hole. Place the key onto a support on a drill press, and with a custom-formed jig on the press, pull the lever down,

HAMMER CHOICE

- Where is the piano going to be placed: on stage, in a home, practice room, performance piano, etc.?
- How comfortable are you with voicing with needles or lacquer?
- Is weight a concern?
- Pianist preferences.

Practical Touch Weight Analysis

K.I.S.S. Your Key-Weight Problems Goodbye

UNDERSTANDING BASIC FACTS ABOUT WEIGHT AND ITS CONTROL

- **Hammer weight** (being at the end of the action lever system) has the most effect on key weight.
- From an **engineering** standpoint, 1 gram of average weight hammers in notes 1-40 will add or reduce the key weight by approximately 6 grams. In reality, however, friction must be considered in this equation, increasing it to 7-8 grams.
- Most all **weight problems** in actions are from notes 1 through 40 and decrease through note 60. Weight is not a normal problem from 60-88 on most pianos.
- It is a **misconception** that all pianos of the same manufacture and model will use the same weight hammers. Diagnose each piano individually.
    - Take a model "M" Steinway as an example. After measuring the weight of the original hammer on notes 1,27, and 44 on numberous pianos of all ages, I have found that note 1 hammer can weigh as little as 7.4 grams and as much as 10.6 grams. This could affect the weight more than 18 grams at the key. Even replacing the number 1 hammer with a weight in the middle of this spread could affect the down-weight by more than 9 grams. I have found hammer number 27 can weigh as little as 6.5 grams and as much as 9.4 grams, resulting in a difference of almost 3 grams or more than 18 grams again at the key. Hammer number 44 is much closer to the same weight on most of the pianos.
- **Different sets** of the same model hammers (i.e. 15lb or 17lb) vary in weight up to 100 grams per set in modern hammers, and more in original hammers. Hammer #1 and the first tenor can very by 3 grams or more different sets.
- Piano keys are **leaded** to the hammers taken off the shelf at the manufacturer.
- At Brooks, Ltd., a large inventory or 400-600 sets of different models and types of hammers with different weights available.

THINGS THAT AFFECT WEIGHT

1. Friction
2. Mass to move (weight of parts)
3. Design
4. Voicing
5. Regulation

MEASURING WEIGHT

1. Down-weight = weight + friction
2. Up-weight = weight – friction
3. Friction = down-weight – up-weight / 2 = 15 grams
4. When measuring up- & down-weight, be consistent with your placement of the weights.

CONTROLLING FRICTION

- All centers and contact points in the action must be restored to their intended specifications as manufactured.
- Most important:

    - Hammer shank flange center: 2-4 grams
    - Whippen flange center: 3-5 grams
    - Whippen cushion shaped and capstan polished
    - Knuckle shaped and clean with lubrication
    - Jack and repetition graphited and burnished
    - Keys bushed, pins clean, keys fit with minimum friction
- To control the weight of the action parts, remove mass where possible from whippens, shanks and hammers.
- Changing action design specifications can control weight. Moving the knuckle 1mm toward the hammer reduces weight by approximately 5 grams at the key.

DETERMINING PROPER HAMMER AND PARTS SELECTION FOR CONTROLLING WEIGHT

- There can be more than a 100 gram difference in individual sets of hammers of any given model.
- Individual pianos were weighted off (leaded) to individual sets of hammers at the factory.

REPLACEMENT HAMMER WEIGHTS

- Different sets of the same model hammer (i.e. 15lb or 17lb) can very in weight up to 100 grams per set in modern replacement hammers.
- More than 100 grams in originals sets
- Hammer #1 and the first tenor can very by 3 grams or more in different sets.
- Piano keys are leaded to the hammers taken off the shelf at the manufacturer which could vary more than 100 grams per set. The lead aids in regulation. When the hammers are hung, they all vary 100 grams or more. Then the keys are weighed.
- To lighten the hammer, taper the tail on the back curve, on the sides, from the tip of the felt to the tail, on the inside curve, and cut the end short.
- The shank can be lightened by narrowing it with sanding.
- Moving the knuckles can also reduce the weight.

USING SAMPLE KITS

- Take an upright backcheck, remove the felt and leather, drill a hole in it and place it on a shank upside down. Place a bunch of washers and huts on the wire to determine the weight of the key that goes up and down.
- With good information it is possible to achieve the target weight.
- Even a set of trimmed hammers could vary between themselves. It doesn't go on a nice taper as one would think. Pick out the hard once and partially drill out some of the lead weights to bring the heavy ones to the light ones.
- Supply the gram weight of the 1st tenor with the hammerhead off the shank.

1. It is best to work on the first tenor note in the piano.
2. Try to match the existing parts.
3. It is best to have a gram scale, that can weigh in tenths of a gram, from 0 to at least 30 grams.

4. It's important to know the weight of sample hammers and parts you are working with.
5. Using a bass or heavy used hammer and put it on a shank.
    a. With a razor blade, proceed to cut felt off of the hammer until you get the proper down and up weight. It should also feel good to you.
    b. Or use the original hammer and add weight or reduce with a razor or knife.
    c. Repeat this sampling at note one.
6. Weight the samples or send to Brooks, Ltd. With your order.

Leading and De-leading

Final Weigh-Off

1. With good information about the individual piano being worked on, it is possible to achieve our target weight.
2. Individual keyweight on critical pianos may need to be adjusted slightly from key to key for evenness.
    a. You may add small key leads to reduce weight
    b. You may partially drill out key leads to increase weight.

Information for Proper Selection of Replacement Hammers

1. **If weight is not a problem:** For accurate hammer selection, if weight is not a problem, it is best to send sample. All #1 and 1st tenor samples received at Brooks, Ltd. Are weighed to gibe us guidance in working out the proper weight hammers and use of action parts to put the action into a target area for proper key weight.
2. **If you are not including samples:** If you are not including samples and the action does not have a weight problem with the original or present hammers, supplying the gram weight of the hammer #1, the first tenor (hammers off shanks) will help in proper hammer selection.
3. **When weight is a problem.** If the action is extremely heavy or too light, it will be best to:
    a. Loosen the centers of hammer and whippen flanges on notes #1, first tenor, to be free enough to swing.
    b. Eliminate any other major friction in action.
    c. Take accurate down and up measurements of the two notes.
    d. Send samples or weigh the 2 hammer heads (off shanks).
    e. Supply all this information.
    f. Call 1-800-326-2440 for technical support or other ways to wok out these weight problems if needed.

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