



The Piano's Enemy: Friction

by Rob Mitchell, RPT

Assuming a piano is tuned, well maintained and voiced, probably the most common complaints I get are along the lines of:

- "The touch is too heavy"
- "I get tired too quickly when I play"
- "I can't play the fast passages"
- "The piano feels sluggish"

All of these point to friction problems in keys and action. In this article, I explore some of the sources of friction and options available for addressing it.

Up Weight and Down Weight

The piano action is a complex system of mechanical levers designed to translate the roughly 10mm of downward travel at the very front of the key to about 46mm of upward travel of the hammer. At the very tip of the key, a piano technician is concerned about two measurements to understand how an action is performing: Down Weight (DW) and Up Weight (UW).

Down Weight is the weight required to move the key all the way down to the point of jack escapement (and with the dampers lifted off). It should be in range of 56 grams -- anything significantly more than that could indicate a friction problem. Similarly, the Up Weight is the weight the key is able to lift, starting from the fully depressed position. This should be in the range of 20 grams and indicates the speed with which the keys will bounce back up to its resting position.

Beyond Up and Down Weight, there are series of equations that determine the overall Touch Weight (and are beyond the scope of this paper). Suffice to say the DW and UW give us a starting point for measuring the piano touch and then taking steps to improve it. I'll walk through the most common friction problem areas in the action, and the usual process for improving things. (As noted at the start of the article, this assumes that piano is already well regulated. There are certainly a number of regulation parameters that can also contribute to a heavy touch).

Key Bushings

There are two pins coming up out the keybed for each key. These pins, the front rail pin and the balance rail pin, are what hold the key in place. A small pocket is cut into each key for the pins and the

pocket is lined with felt. The thickness of the felt needs to be "just right". Too thin (or worn out) and the keys will have a rattling, knocking feel, too thick and the key will feel hard to play. Piano technicians will use a combination of easing (compressing the felt and wood), sizing (conforming the felt to the right dimension) or lubrication to balance the key bushings between too loose and too tight. A variant on this problem in older pianos is a build of corrosion on the pins, which would need to be cleaned off if present.

In the same neighborhood is the balance rail hole, located in the bottom of each key for the balance rail pin. If this hole is too tight, it can also contribute to a sluggish feeling. Easing the balance rail holes involves widening the holes very slightly and is commonly needed on new pianos.

Capstain and Jack

At the back end of the key is the capstain, usually either a brass post or wooden dowel. When the front of the key is pressed down, the back of the key rises with the capstain pushing up on the wipen foot (which is usually covered in leather). Although most of the motion is upward, there is also a slight forward motion as the key actually rotates around the balance rail. To minimize friction here, the top of the capstain must be smooth, polished and corrosion free, and may require lubrication.

Deeper into the action is the jack, which pushes up against the leather coated knuckle on the bottom of the hammer shank. At the point of let off or escapement, the tip of the jack moves forward out from underneath the knuckle. Since this is wood rubbing against leather, it's another source of friction and usually requires some type of lubrication to insure free movement.

Flanges

A flange is just piano-speak for a "hinge". It is usually constructed as a metal pin inserted into a hole that is again lined with a very small piece of felt. Depending on the type and brand of the piano, there can be four or five flanges *per key* in the piano action.

Flanges that are too tight can be a big contributor to a piano with a heavy touch. Usually either lubrication

or sizing of the felt bushing will solve most problems. In some cases it may be necessary to repin entire sets of flanges (not as bad as it sounds) to get the correct friction setting. Very low friction in the flanges is generally the goal, but surprisingly, a tiny amount of friction is needed to keep the piano from feeling "out of control".

Beyond Friction

Once all of these areas have been checked and addressed as needed, the Down Weight, Up Weight and overall touch of the instrument should be dramatically improved. Going through this process will take the vast majority of instruments to the point that the owner is quite happy. But of course, there is still the occasional pianist who would like to take things further, and we have a few options here.

The first involves moving the pivot point of the key around the balance rail. Moving the pivot point away from the player creates a lighter touch and moving it towards the player gives the piano a heavier touch (rare, but occasionally someone will ask for this).

There are a couple of ways to go about this. Perhaps the easiest to explain is the installation of thin piece of veneer on top of the balance rail, either in front of (heavier touch) or behind (lighter touch) the balance rail pin. This method is easy to install but creates more regulation work since now the key height and other regulation parameters must be checked and corrected as needed.

The other option involves modifying the felt key punching underneath every key at the balance rail pin. Trimming off the front half or the back half of the punching (for a correspondingly lighter or heavier touch) is a very effective way to modify the Touch Weight. There are pro's and con's to each method involving both the work needed of for the initial modification and the amount of follow up regulation required. But what's nice about these is that they are both fairly easy to try and are reversible if the piano player is unhappy with the results. Both of these techniques may be used on either grand or upright pianos.

(Special note regarding Steinway Accelerated Action. Steinway uses a different design around the balance rail pin from almost every other manufacturer. Instead of the tradition felt punching, Steinway pianos have a small piece of half-round wood that is layered with felt. The intent of this is to change the leverage ratios as the key is depressed and it works very well. But the previously mentioned methods of

moving the pivot point will not work with this configuration.)

There's a relatively new product on the market for modifying the Touch Weight of grand pianos: the TouchRail™. A rail is custom made for your piano and is installed across the tops of the keys just in front of the balance rail pins. Above each key is an adjustable spring pushing down. In addition to significantly improving the overall Touch Weight, a more consistent touch can be achieved by individually adjusting each key spring.

The Gold Standard

Many years ago, a piano rebuilder named David Stanwood became increasingly frustrated with the inconsistent results of his rebuilds. Some pianos would come out with wonderful touch and responsiveness, while others, not so much. With his engineering background, he set out to understand why this was so. In what is considered to be one of the more significant developments in piano technology in recent history, he came up with the Stanwood TouchDesign™ System.

David's patented process starts with detailed measurements of a piano action followed by significant modifications. These changes can include modifying the hammer weight, repositioning the capstain, repositioning the knuckle and modifying the lead weights in the keys. Since these changes are so involved, they are most typically done as part of a larger instrument rebuild (though not exclusively). The process has gained such widespread approval that some of major rebuilders won't even consider taking in an instrument for rebuild unless it includes doing the Stanwood process.

For more information or to request an appointment, visit www.mitchellpianoservice.com.