A Cure for Your Bad Back (Action)

A Simplified Approach for Installing the

Baldassin "3-in-1" Underlever System

by Renner USA

Rick Baldassin, RPT

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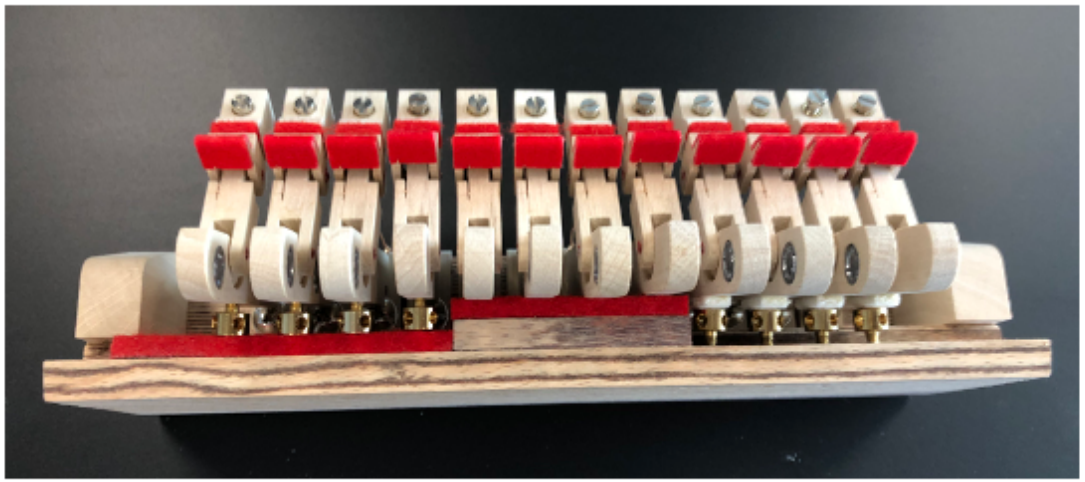
The following presentation will help you install the new ***Baldassin "3-in-1" Underlever System*** by Renner USA. If you have used the Renner Universal Underlever system in the past, the installation procedure is similar. There are some additional steps for the installation of capstans, and the location procedure has been simplified.

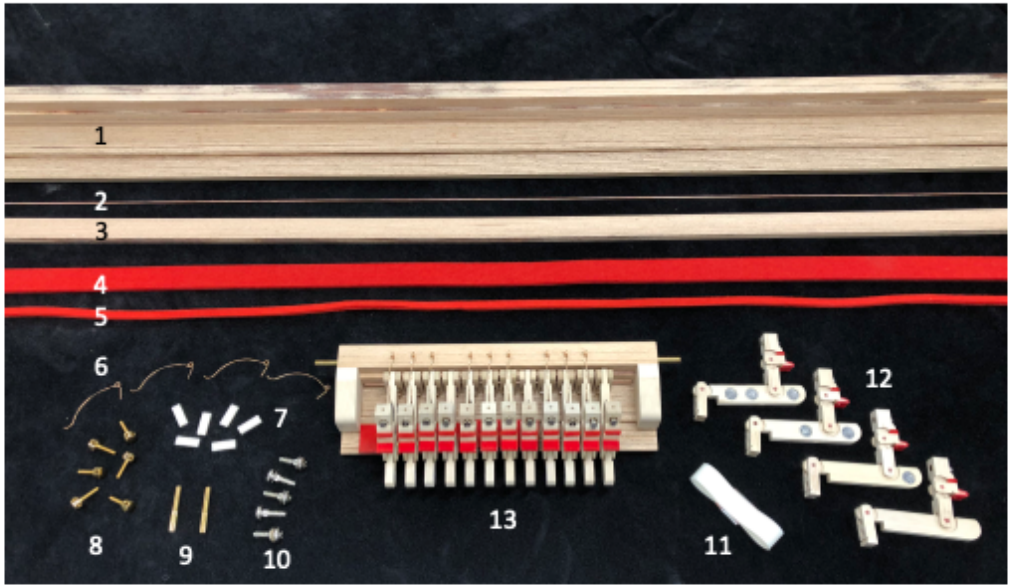
Baldassin "3-in-1" Underlever System



Capstans in the Underlevers | No Capstans | Capstans in the Tray

The ***Baldassin "3-in-1" Underlever System*** by Renner USA maintains the design of the Renner Universal Underlever System, with the flexibility of adding capstans, either in the underlever or the tray, if desired.

Baldassin "3-in-1" Underlever System

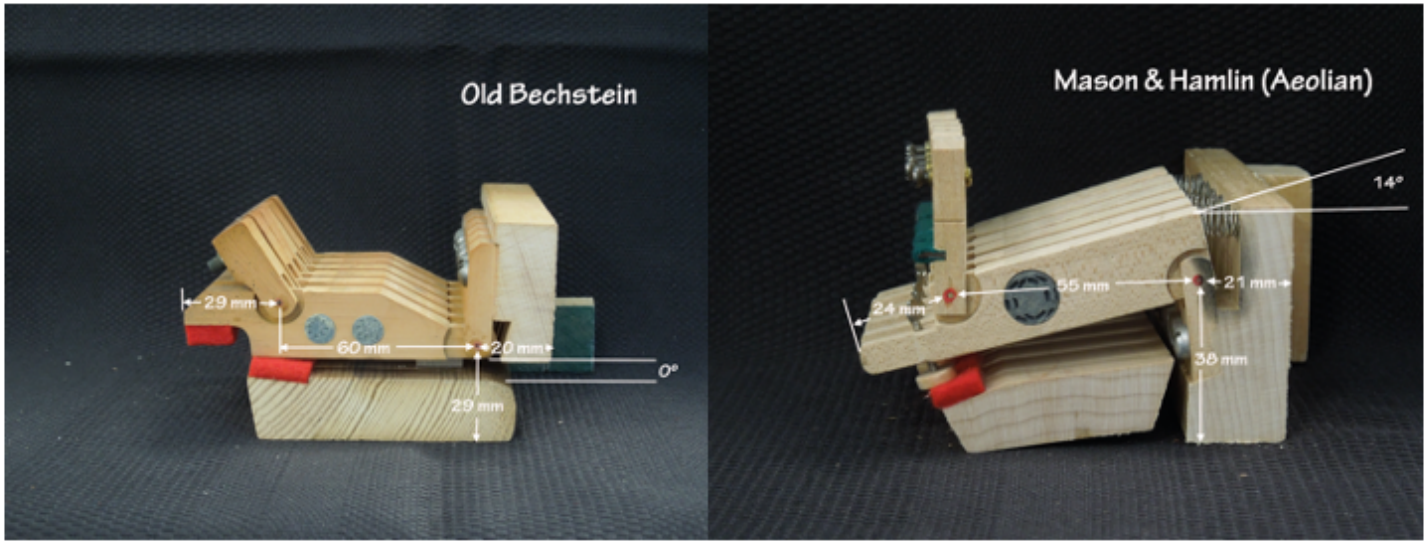


Here are the components of the ***Baldassin "3-in-1" Underlever System:*** 1) Damper Tray. 2) Keeper Wire. 3) Wooden Shim. 4) Damper Tray Felt. 5) Damper Stop Rail Felt. 6) Springs. 7) Action Cloth Pieces. 8) Capstans. 9) End Pins. 10) Flange Screws. 11) Paper Strip. 12) Underlevers—3 lead, 2 lead, 1 lead, 0 lead. 13) Assembled System.

The Need for a Universal Underlever Replacement System

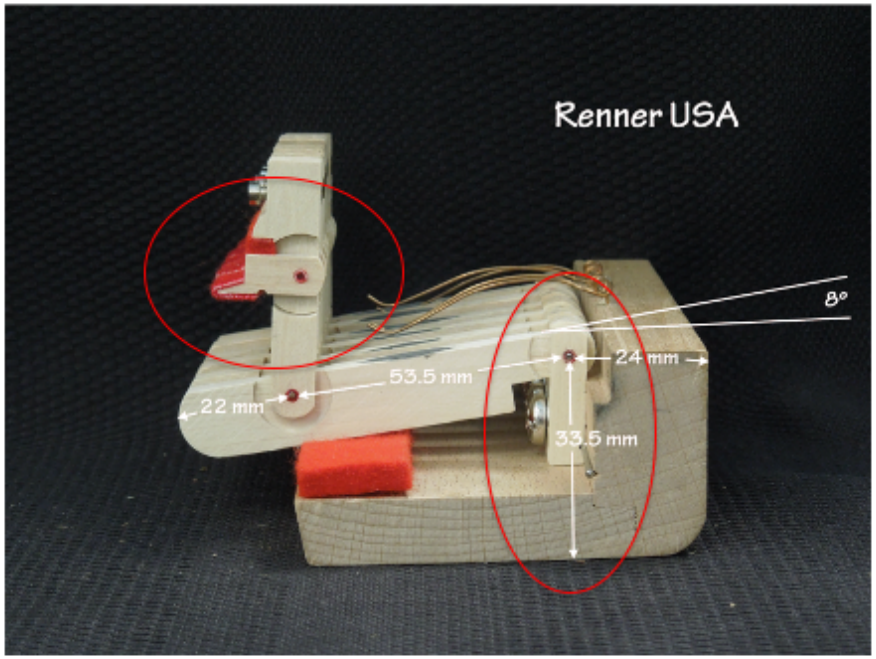
Underlever systems of widely differing designs have been used by the various manufacturers over the centuries. You can see from the above pictures just how different they are, and this is a small sampling of the systems that have been used!

With so many different systems in the various pianos, direct replacement with a single system is just not possible!



Chances are good that the system you are installing will not be a direct replacement for the system you are removing. This system, however, can be successfully installed in the piano, and will likely outperform the original system due to the improved geometry in the design.

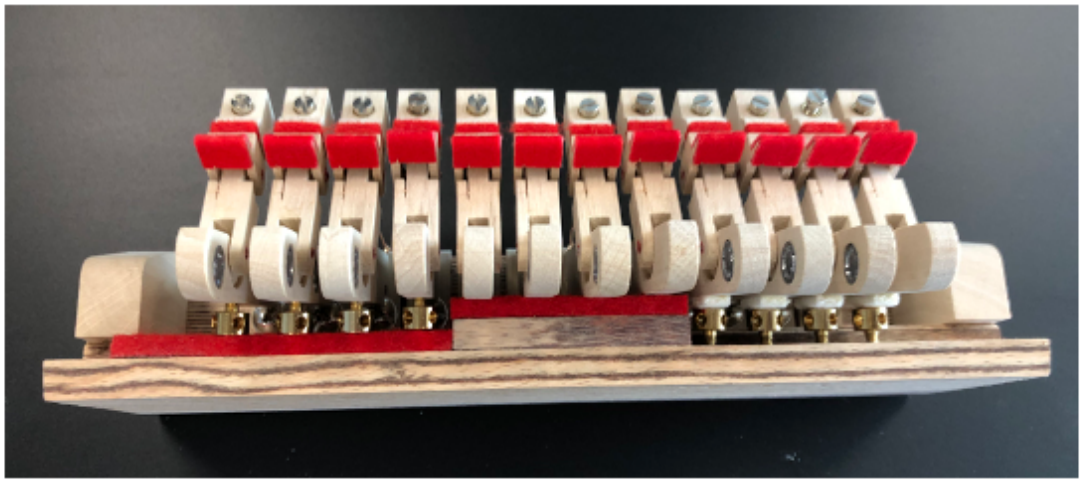
Development of the Renner USA Universal Underlever System



ca. 1990

The Renner Universal Underlever System was developed in 1990 and incorporated the best geometry and design features of early underlever systems from various manufacturers. Some conveniences and improvements such as hinged sostenuto tabs were added, and the underlevers were mounted vertically to the rail with screws, making servicing much easier.

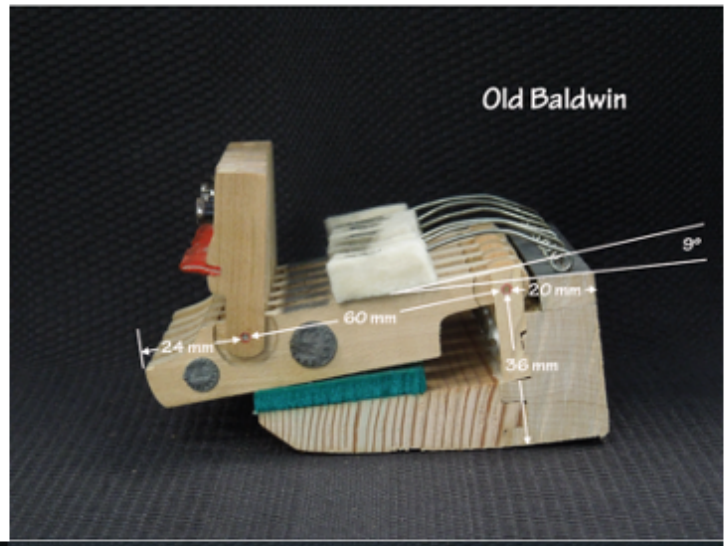
Baldassin "3-in-1" Underlever System

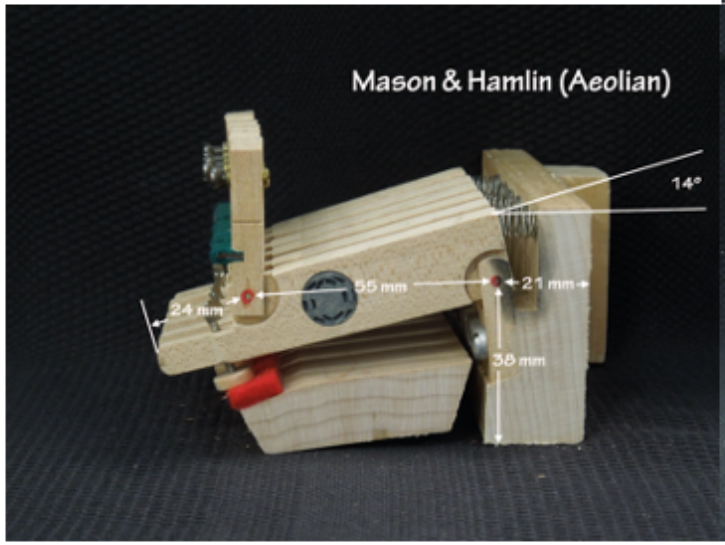


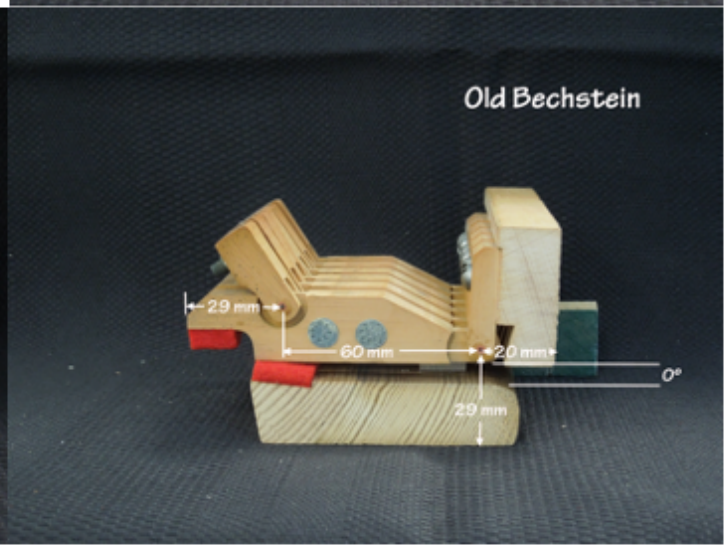
Capstans in the Underlevers | No Capstans | Capstans in the Tray

The ***Baldassin "3-in-1" Underlever System*** by Renner USA maintains the design of the Renner Universal Underlever System, with the flexibility of adding capstans if desired, either in the underlever or the tray.

Wide Variety of Applications

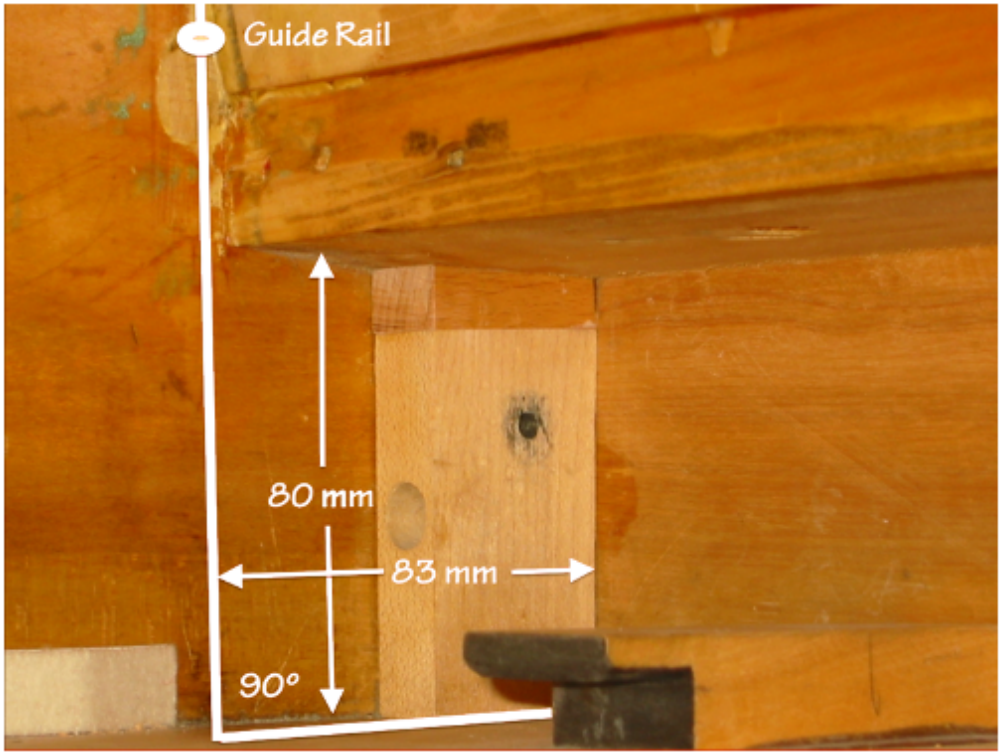






The ***Baldassin "3-in-1" Underlever System*** can be retrofit into a wide variety pianos. Some of the systems used in these pianos have a similar design, while others are quite different. The ***Baldassin "3-in-1" Underlever System*** has been successfully used to replace the underlever systems in each of these pianos, and many more. By following this installation procedure, the probability that this system can be fit into your piano is very high!

Space Requirements for the "3-in-1" Underlever System



The minimum height for the cavity into which the system will fit is 80 mm and depth from the rear of the cavity to the guide rail is 83 mm. If the depth of the cavity is less than 83 mm, you may need to plane away material from the rear of the tray to allow it to pivot properly.

Baldassin "3-in-1" Underlever System

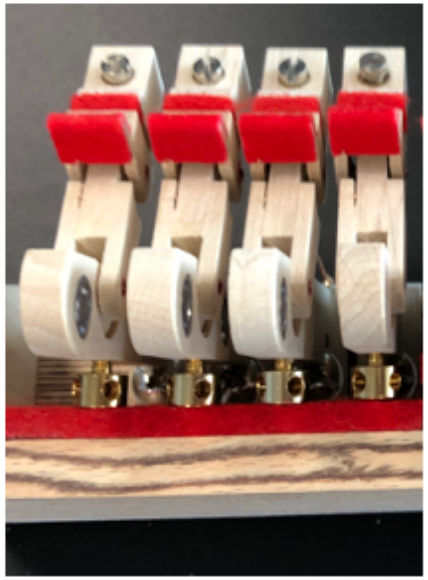
Installed without capstans

- Geometry incorporates best features of the Renner USA Universal Underlever system, including sockets, hinged tabs & removable underlevers
- Requires less cavity height
- Accommodates lower key end height
- Can be equipped with springs as desired
- Can be fit into Baldwin, Bechstein, Blüthner, Fazioli, Knabe, Mason & Hamlin, Steinway, Yamaha, and many other makes of piano*

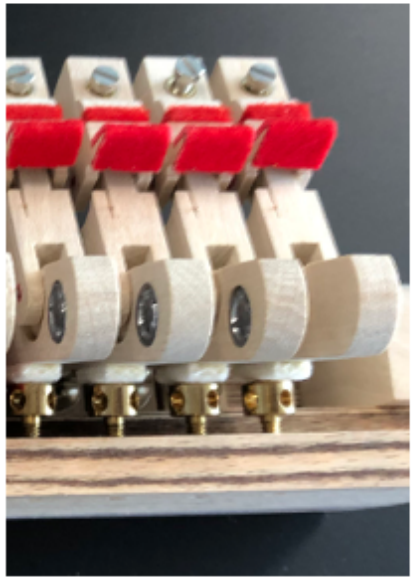
This shows the ***Baldassin "3-in-1" Underlever System*** without capstans and a list of the features and benefits of the system installed without capstans.

*This list is a sampling of known piano makes into which the system is capable of being installed and is not intended to be comprehensive nor imply endorsement.

Baldassin "3-in-1" Underlever System



Installed with capstans
in the underlevers

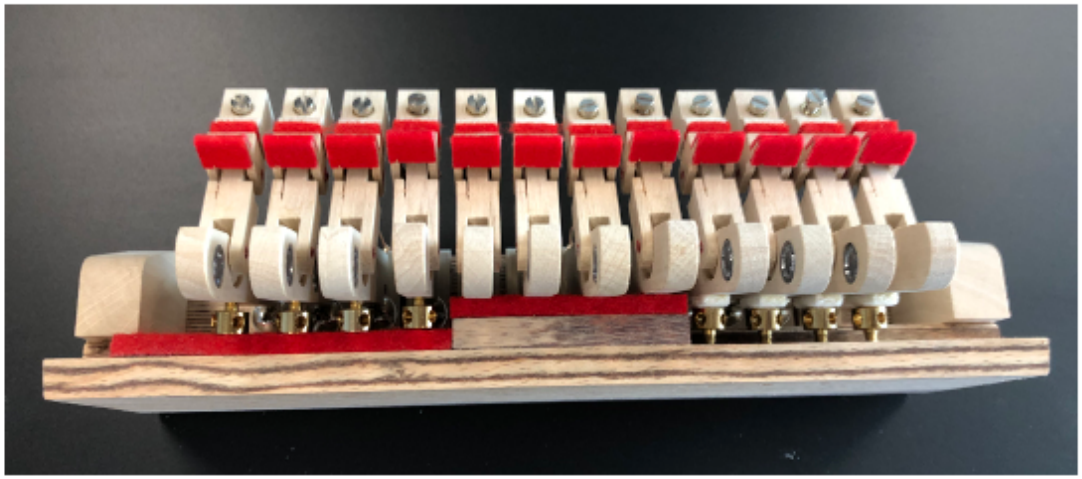


Installed with capstans
in the tray

- Easier to regulate damper lift with tray

The additional benefit of installing the ***Baldassin"3-in-1" Underlever System*** with capstans, either in the underlever or in the tray, is that it is easier to regulate the damper lift with the tray.

The Baldassin "3-in-1" Underlever System Installation Procedure



A Simplified Approach

The following is a simplified approach to installing the ***Baldassin "3-in-1" Underlever System*** by Renner USA.

Confirm Existing Drilling Scale

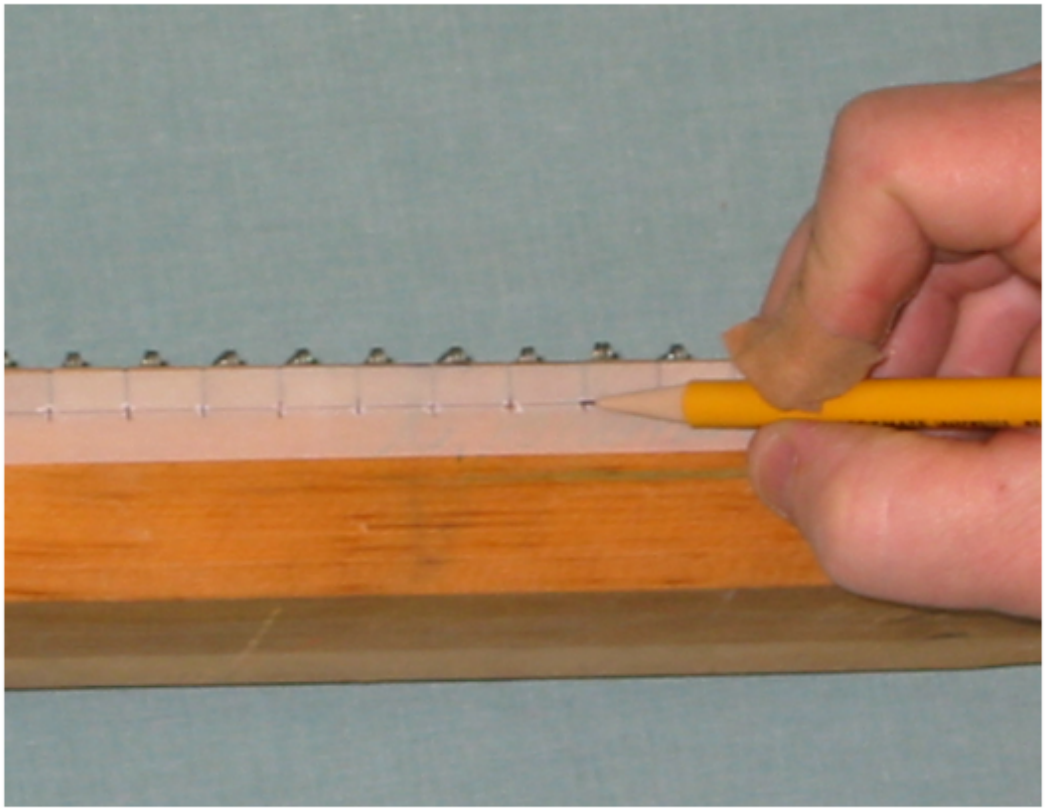
Confirm the underlever locations on the existing system by placing the old system on the key tails while outside of the piano. The treble side of the underlevers should line up with the treble side of the key tails. Make note of any discrepancies and adjust before drilling the new tray.

Transfer Drilling Scale – Method 1

There are four methods presented here to transfer the drilling scale.

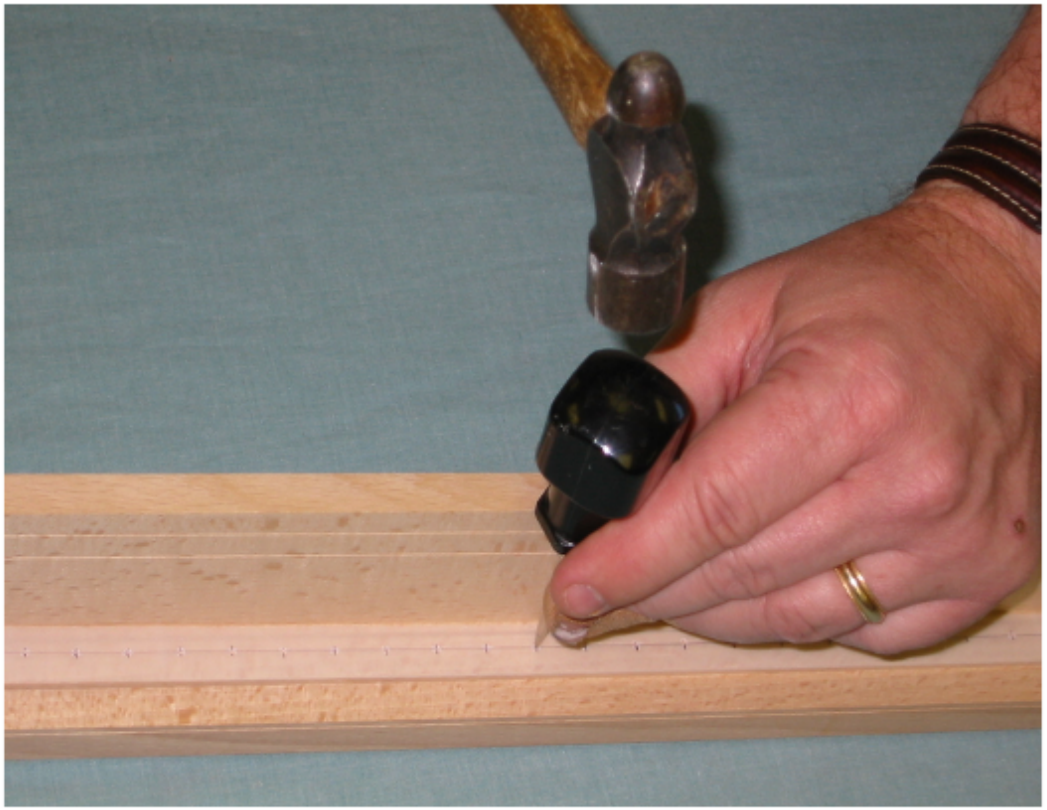
Method 1 – Use the paper strip included in the kit to transfer the drilling scale. Stretch and tape this paper to a work surface and draw a line down the center of the strip with a pencil.

Transfer Drilling Scale – Method 1



Next, stretch the scale paper along the back side of the old tray and mark the treble side of each flange with a pencil. This will be more accurate than approximating the center of each flange.

Transfer Drilling Scale – Method 1

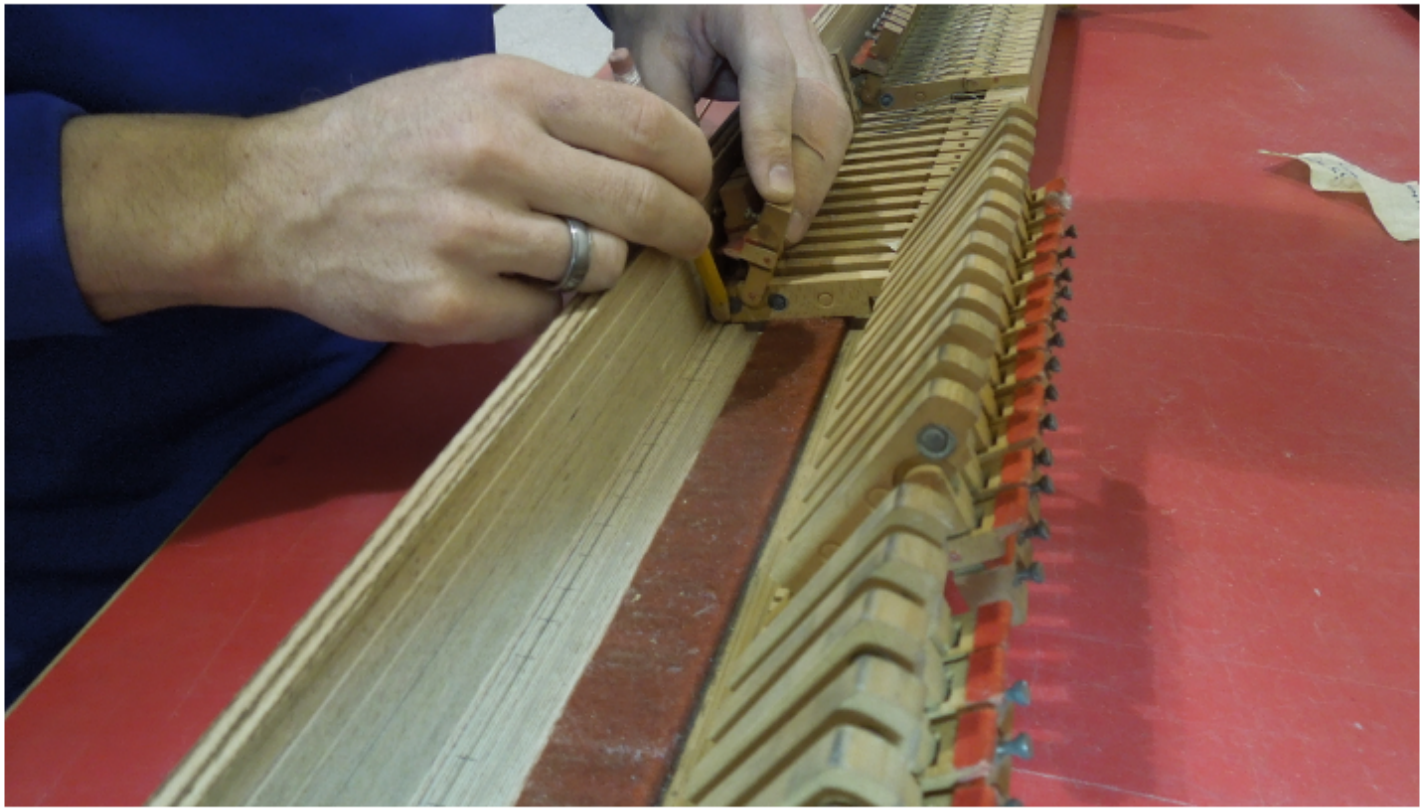


Finally, stretch and tape the scale paper onto the new tray as shown. Be sure to leave adequate length on both ends of the tray, which will be trimmed to length later. Mark the tray by transferring the pencil marks with an awl, as shown.

Transfer Drilling Scale – Method 2

Method 2 – Mark the new tray from the location of the existing underlevers. Clamp the old system and new tray as shown.

Transfer Drilling Scale – Method 2

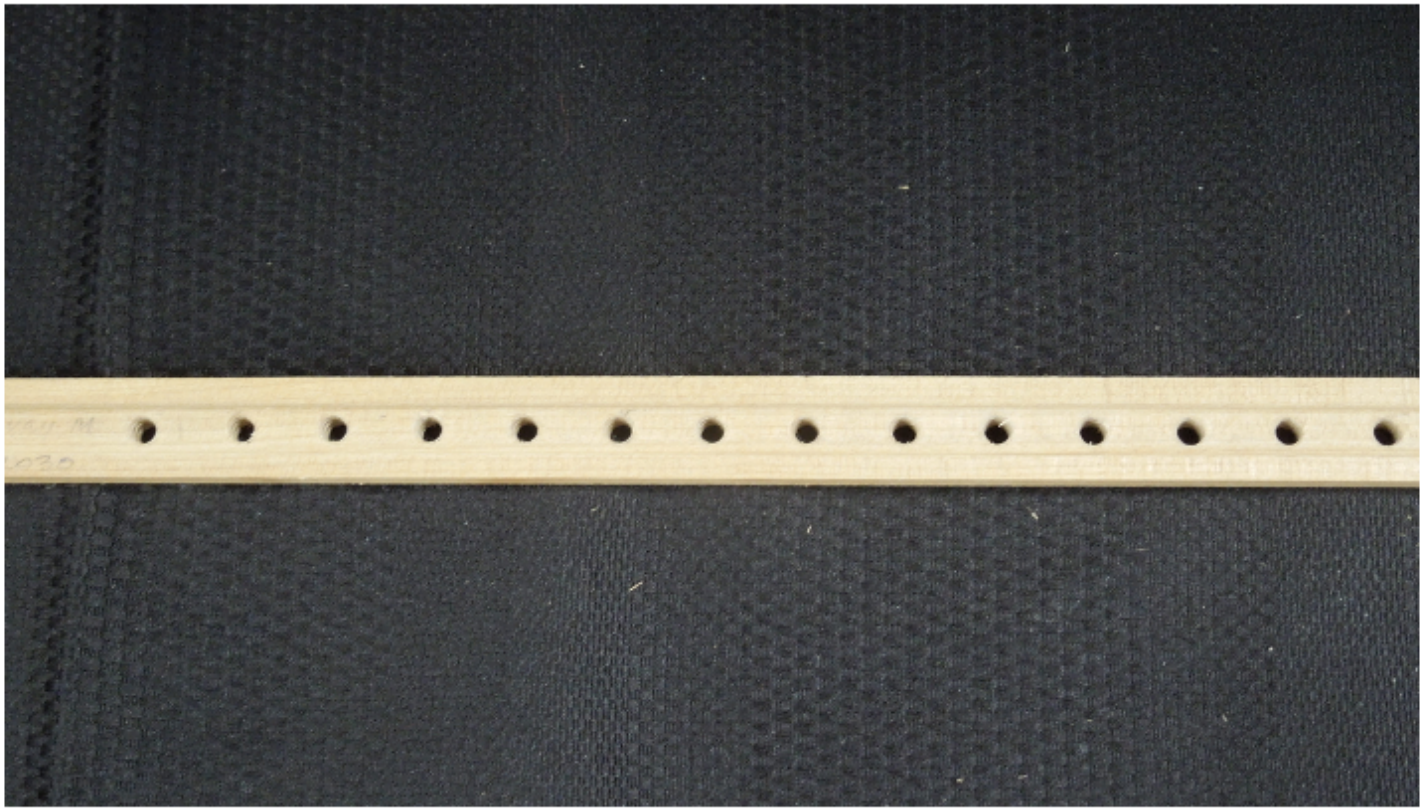


Mark the location of the treble side of each underlever on the new tray with a pencil, as shown.

Transfer Drilling Scale – Method 2

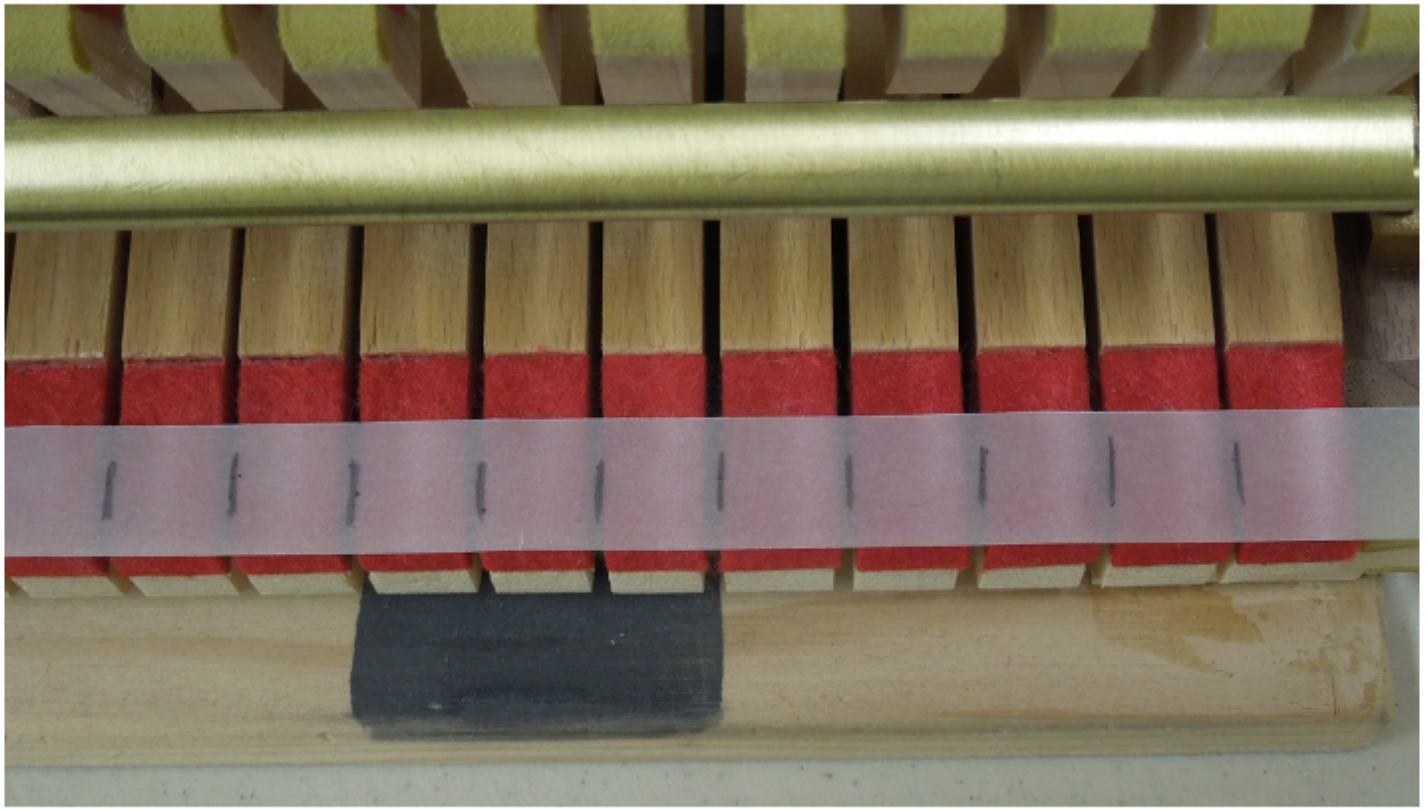
Mark the drilling locations along the scribe line at each pencil line using an awl or transfer punch. There is a scribe line in the tray along which the screw holes should be drilled.

Transfer Drilling Scale – Method 3



Method 3 – If the underlevers on the existing system were attached with screws, remove the underlevers and cut the old tray, leaving only a thin strip that includes the original screw holes. Locate this strip on the new tray and transfer the hole locations using a transfer punch.

Transfer Drilling Scale – Method 4

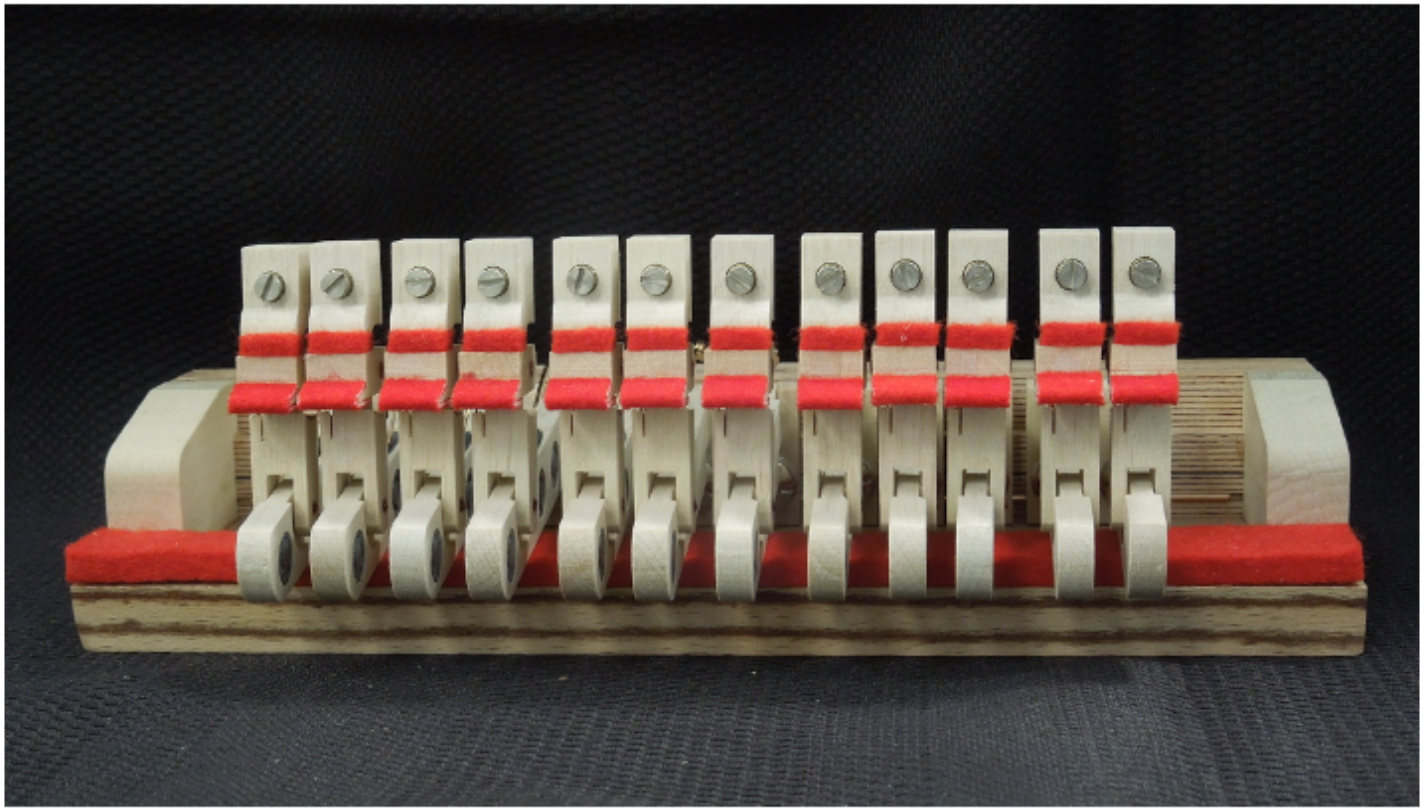


Method 4 – Determine the drilling locations from the tails of the keys. Stretch the scale paper across the key tails and mark the treble edge of each key end with a pencil.

Transfer Drilling Scale – Method 4

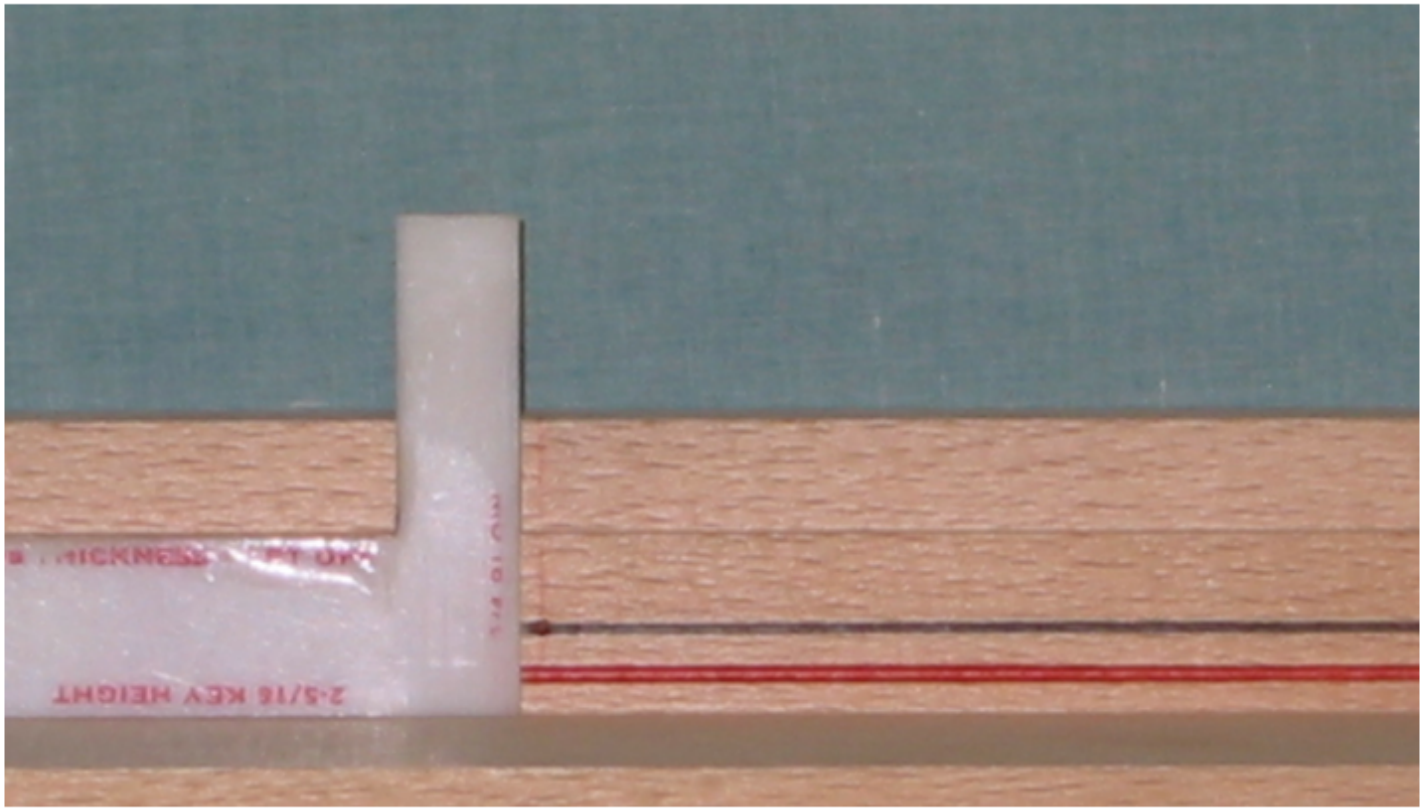
Note that the widths of the key ends may not be equal. Try to even out the spacing before stretching the scale paper on the new tray and transferring the marks with an awl.

Transfer Drilling Scale – Method 4



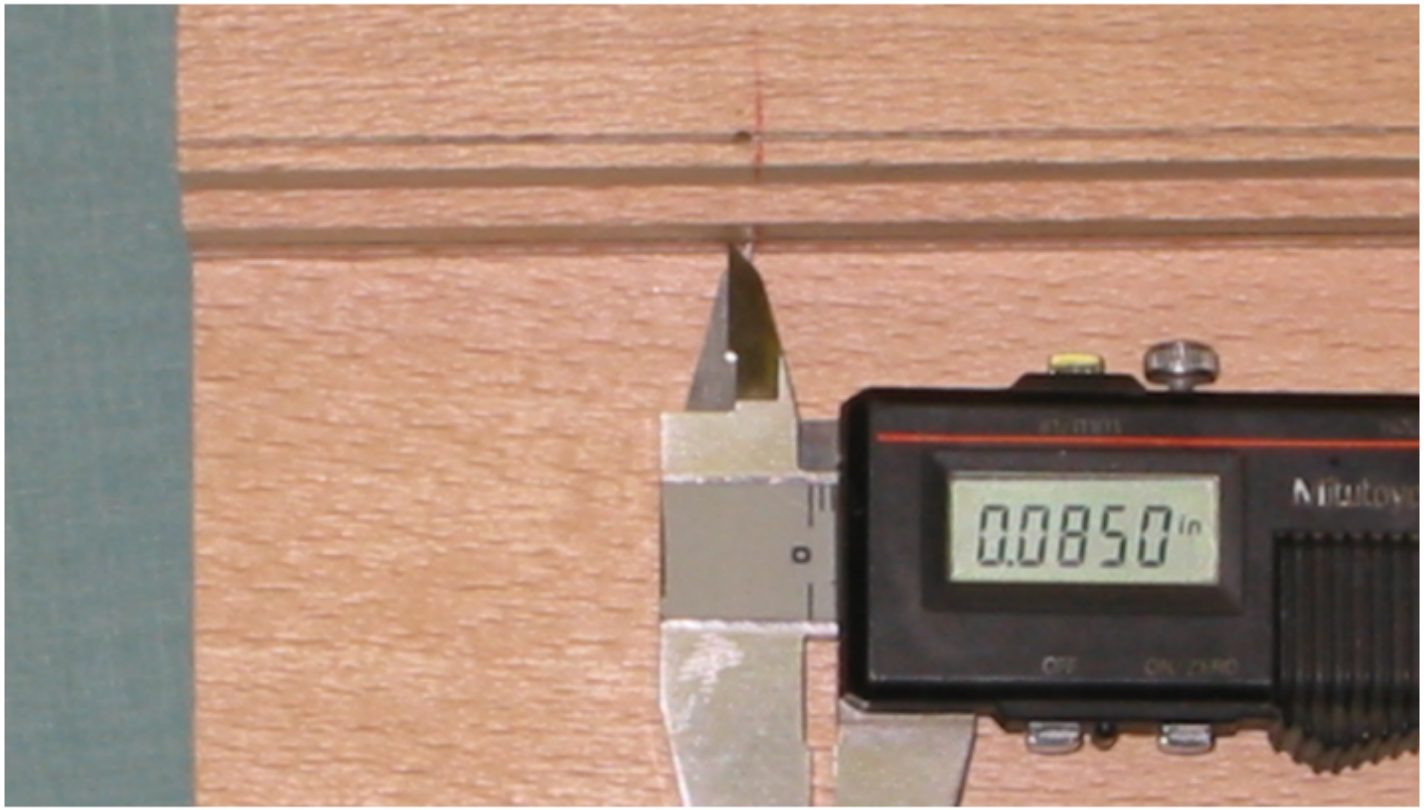
If you don’t even out the marks on the scale paper, the underlever spacing will work perfectly, however, the job will not look professional.

Mark for Springs



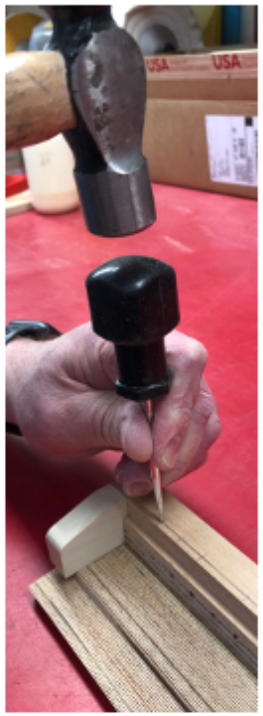
If springs will be installed, transfer the location of hole #1 to the top of the tray using a small square.

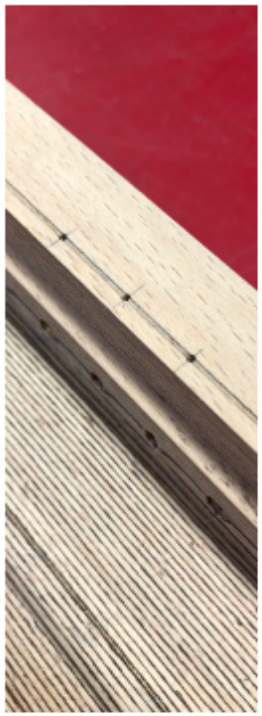
Mark for Springs



The location of the spring holes needs to be offset towards the bass by 0.085” to account for the spring coils and allow the spring to be centered in the underlever.

Mark for Springs





Locate the scale paper with reference to this offset location and transfer the marks to the tray using an awl. Since springs are not typically installed on all the underlevers, determine how many will have springs, and transfer only that number of marks for drilling.

Drill Flange Screw Holes

The new flange screws no longer require a custom bit to drill the screw holes. Use a #29 or 9/64" drill that is 6" long (available from Renner USA). If you have the custom bit from previous installations, it will work with the new screws, though it is not necessary.

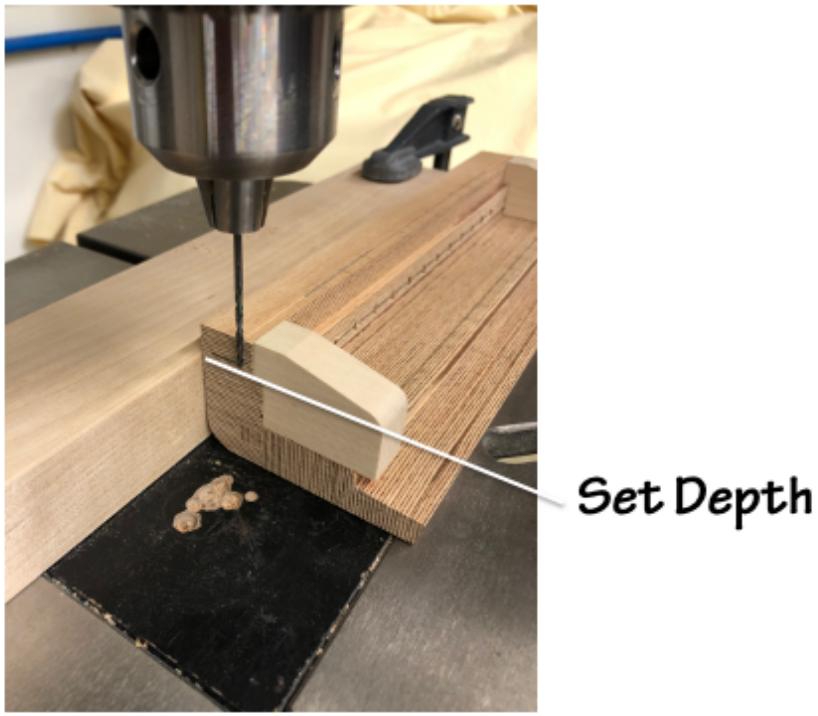
Drill #29 (0.136”) or 9/64” x 6”

To drill the flange screw holes, place the tray on its back as shown. Use a fence against the bottom of the tray to insure that of the holes are drilled along the scribe line. Set the depth of the hole to accommodate the length of the screw, without drilling through the back of the tray.

Drill for Springs

To establish the depth of the spring holes, place a spring at the end of the tray. Place a thin spacer between the top of the tray and spring coil, as shown. Mark the length of the spring tail on the end of the tray with a pencil.

Drill for Springs

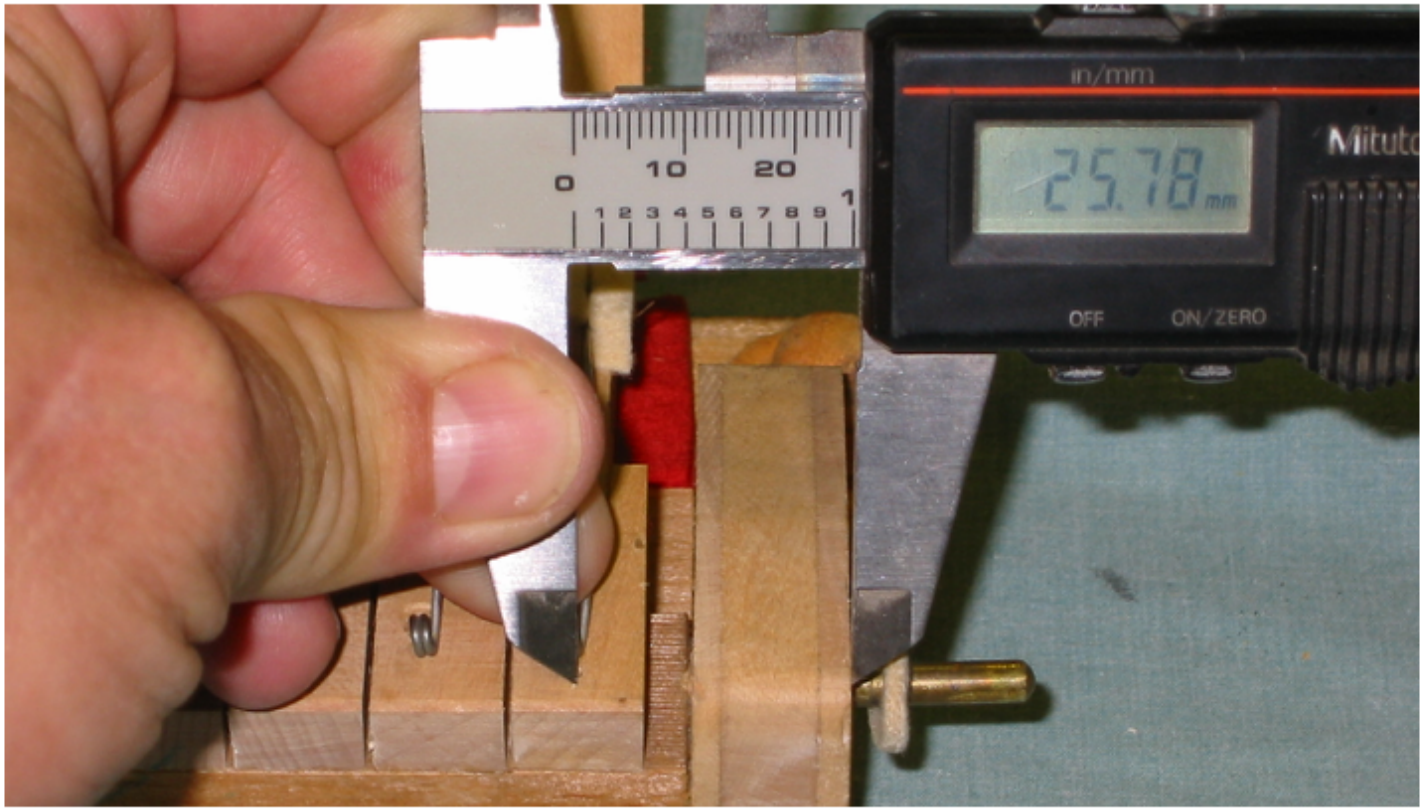


Set the depth on the drill press to this height. When the springs are installed, the coils should not touch the tray.

Drill with #46 (0.081”) Bit

Install a fence along the back of the tray to be sure the holes are drilled along the scribe line. Drill the holes to the proper depth using a #46 (0.081”) bit.

Cut Tray to Length

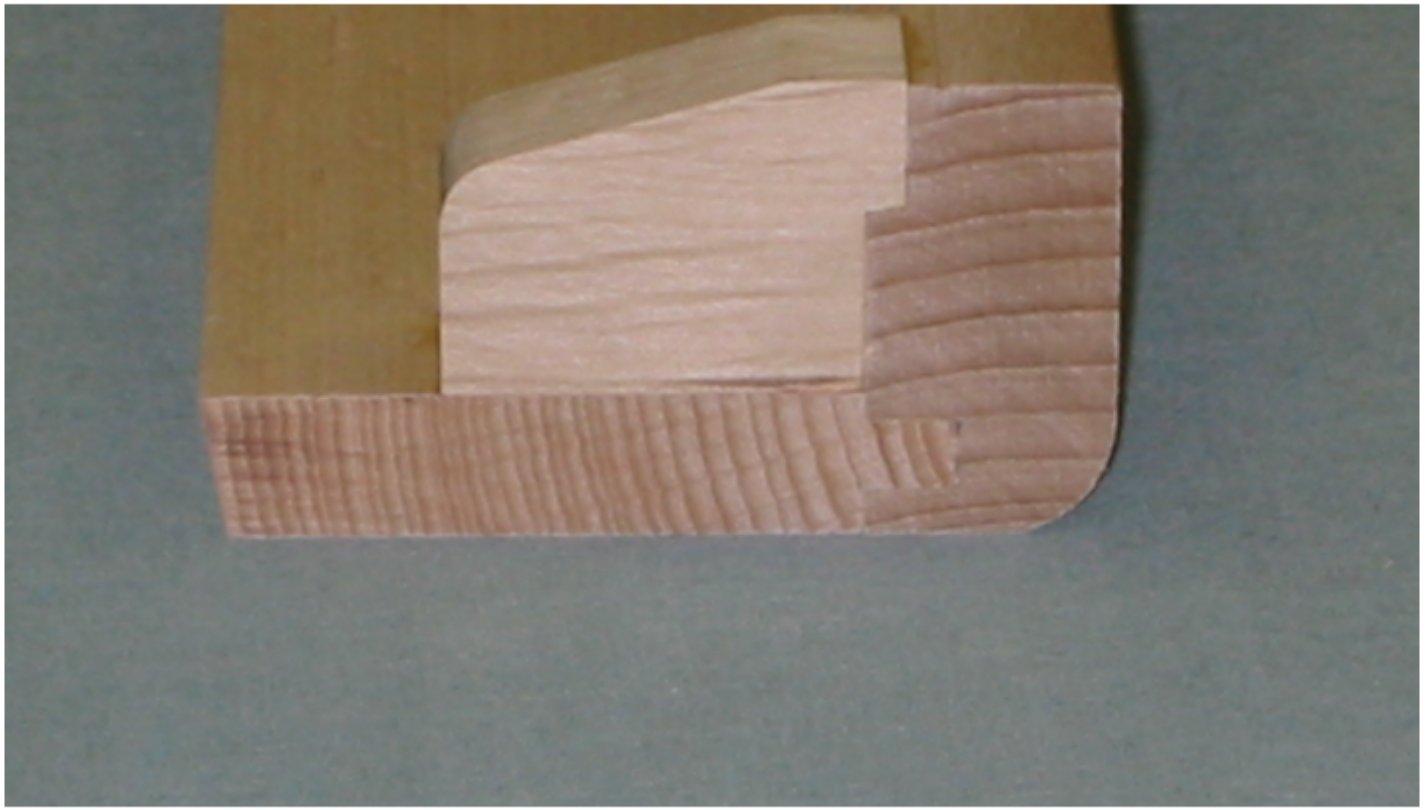


To cut the tray to length, measure from the center of flange #1 to the bass end of the tray.

Cut Tray to Length

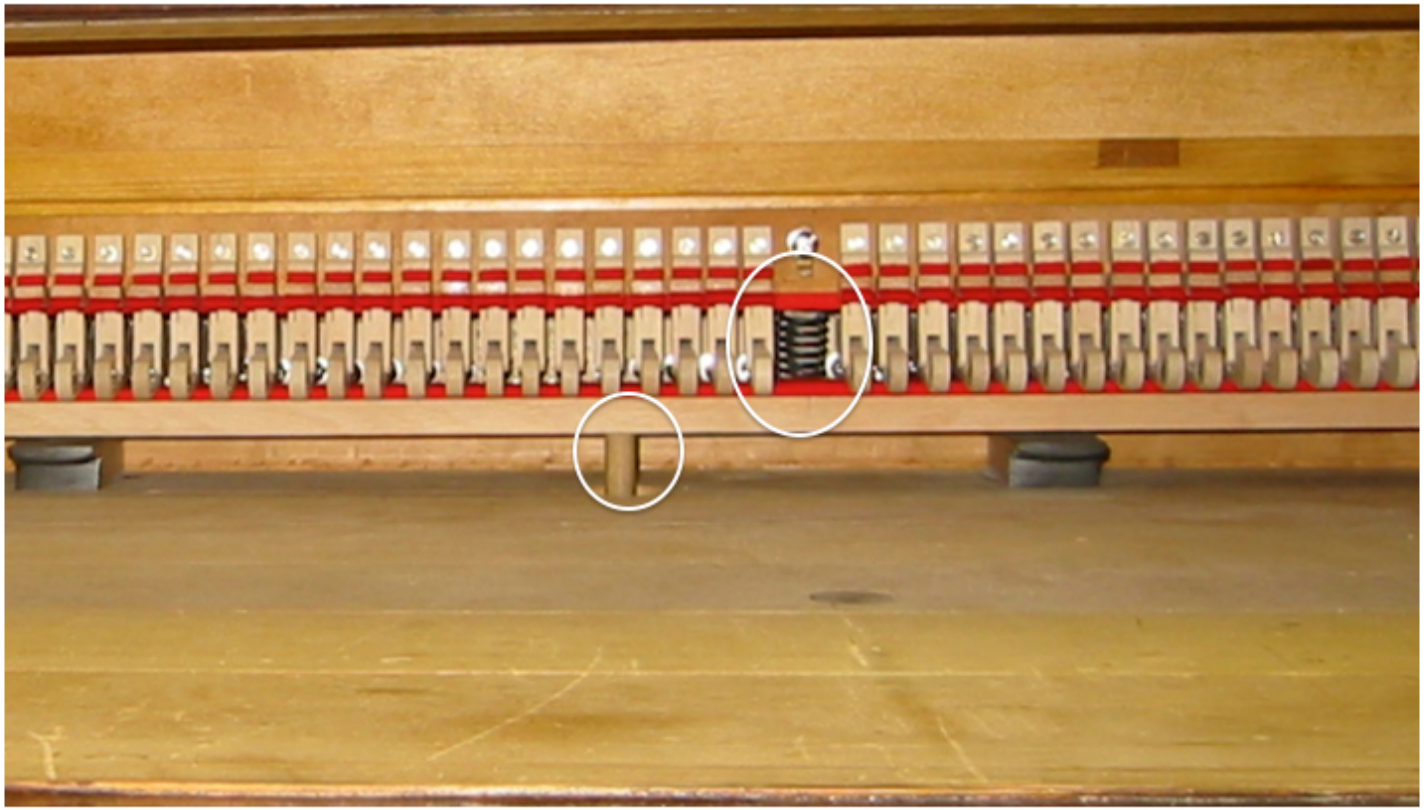
Transfer this measurement to the new tray and cut the bass end of the tray to length. Measure the overall length of the old tray, transfer the measurement to the new tray, and cut the treble end to length.

Install End Blocks



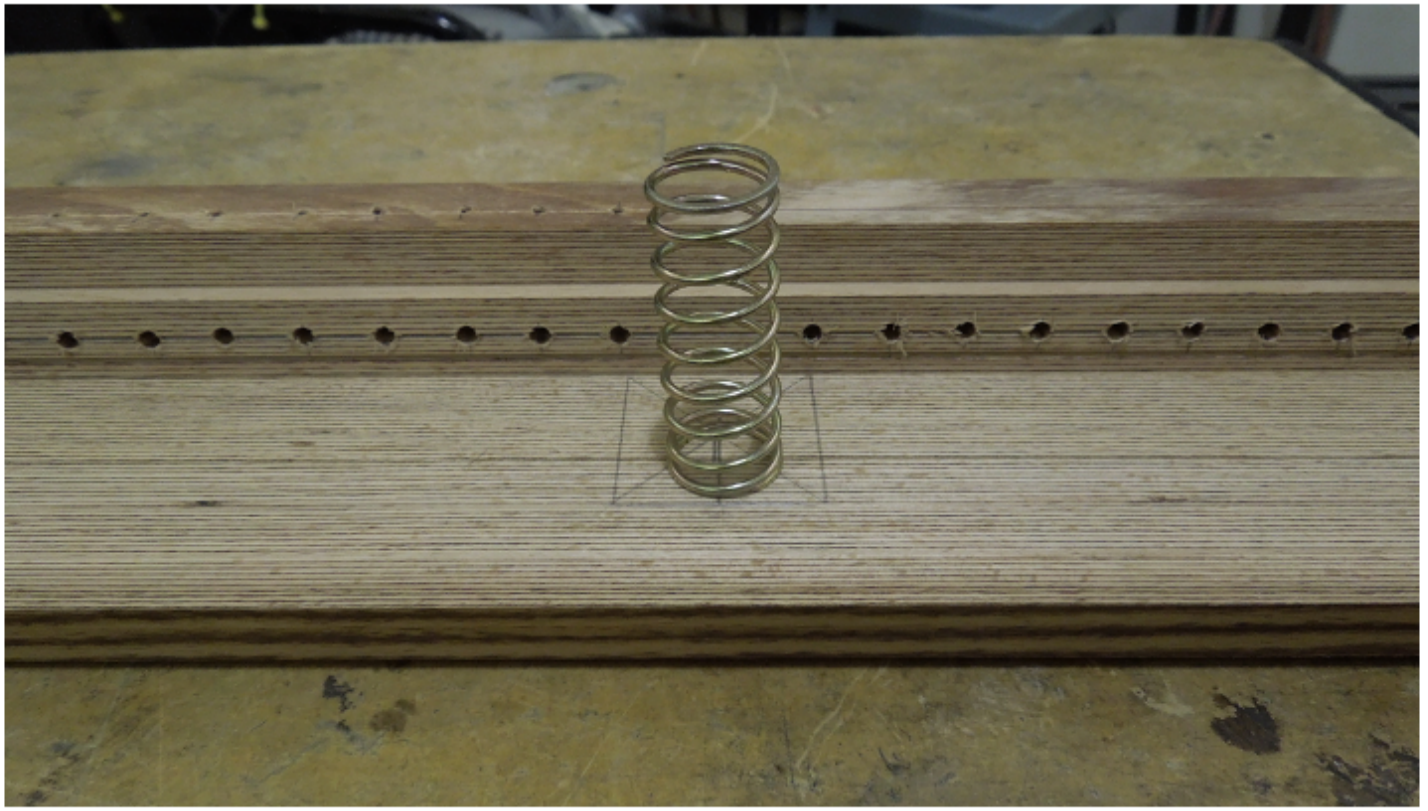
To install the end blocks, apply glue to the blocks and install at each tray end. Light clamping pressure can be applied while the glue is drying.

Return Spring



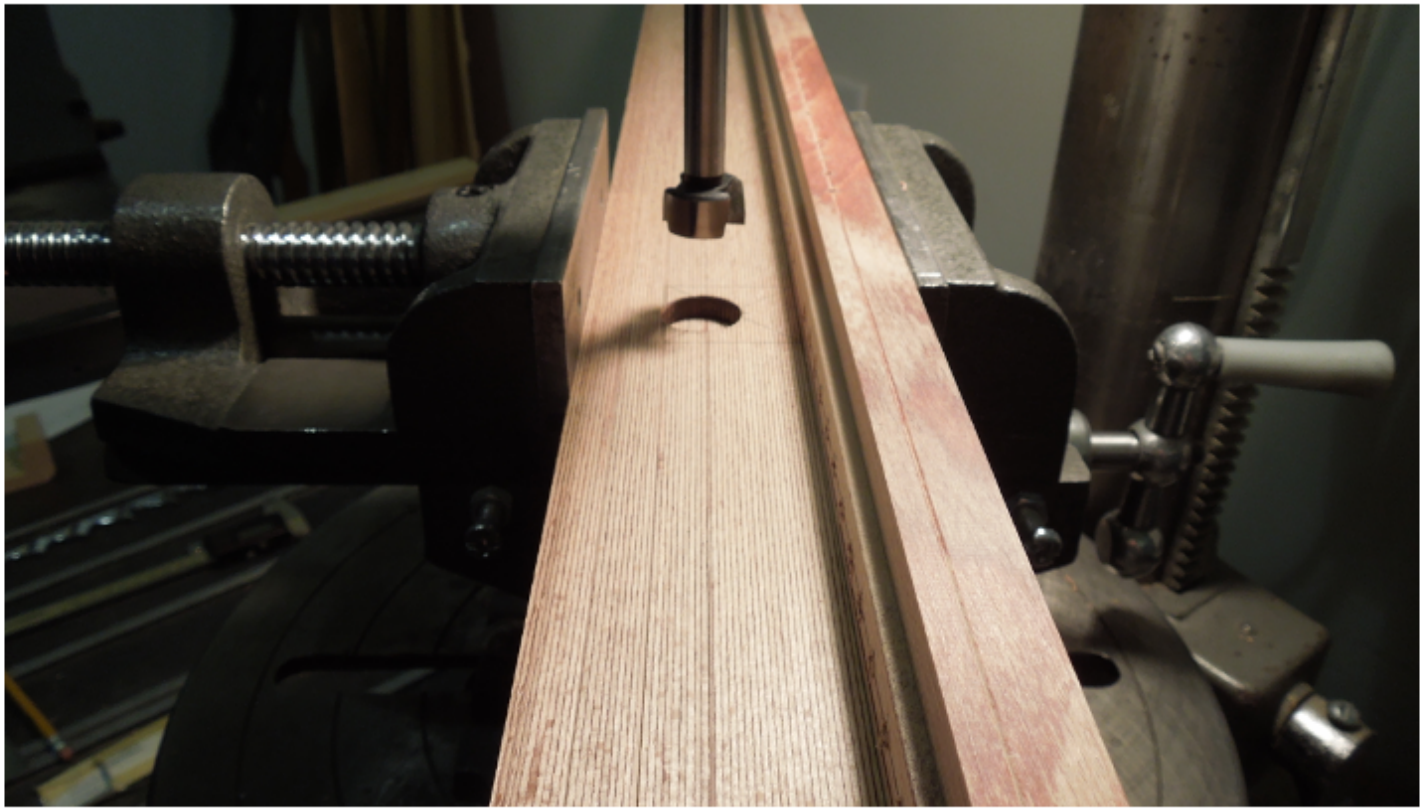
When locating the tray return spring, it is recommended that the spring be installed in the space between the midrange and treble section (as shown above), even if it was located at the treble or bass end originally. The downward pressure from the spring should be as close as possible to the upward pressure of the pitman to prevent the tray from warping.

Return Spring



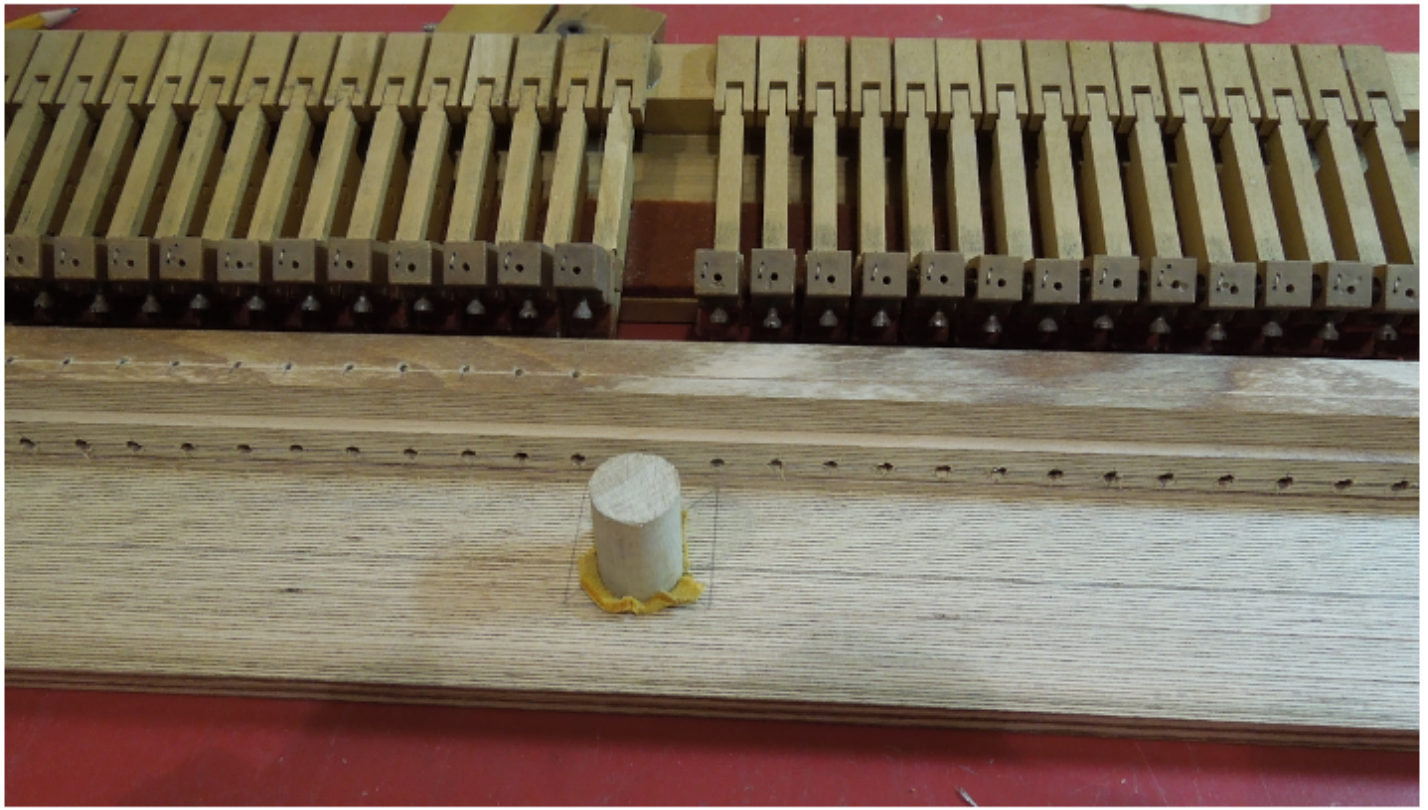
Locate the spring in the space between the midrange and treble sections, as shown above.

Return Spring



Drill a hole in the tray to accept the spring using a Forstner bit. The bit size should be the diameter of the spring plus two thicknesses of buckskin that will be used to line the hole. Common sizes are 3/4” and 7/8”.

Return Spring

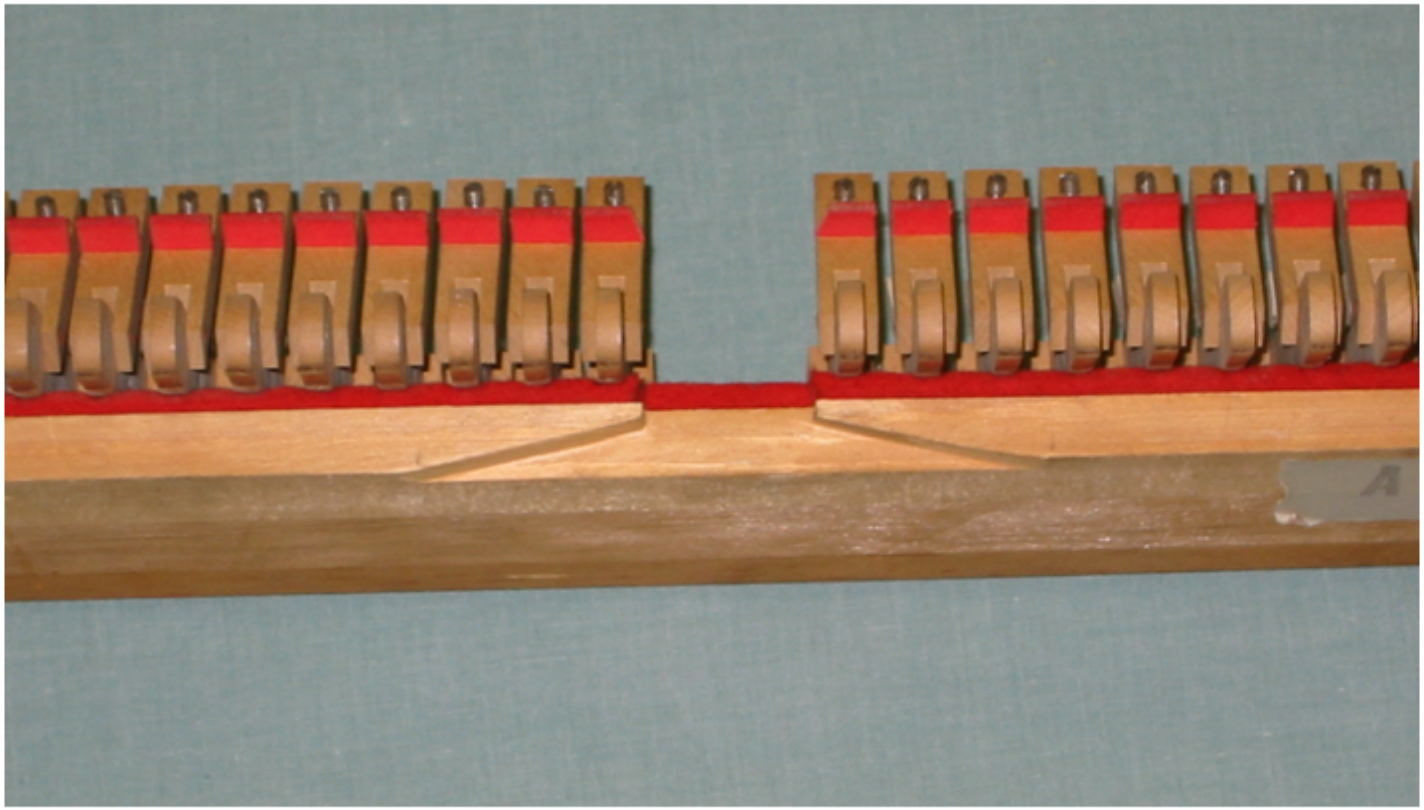


Glue a piece of buckskin into the hole. Clamp in place using a dowel that is the same diameter as the spring. Trim the edges of the buckskin flush to the tray once the glue has dried.

Return Spring

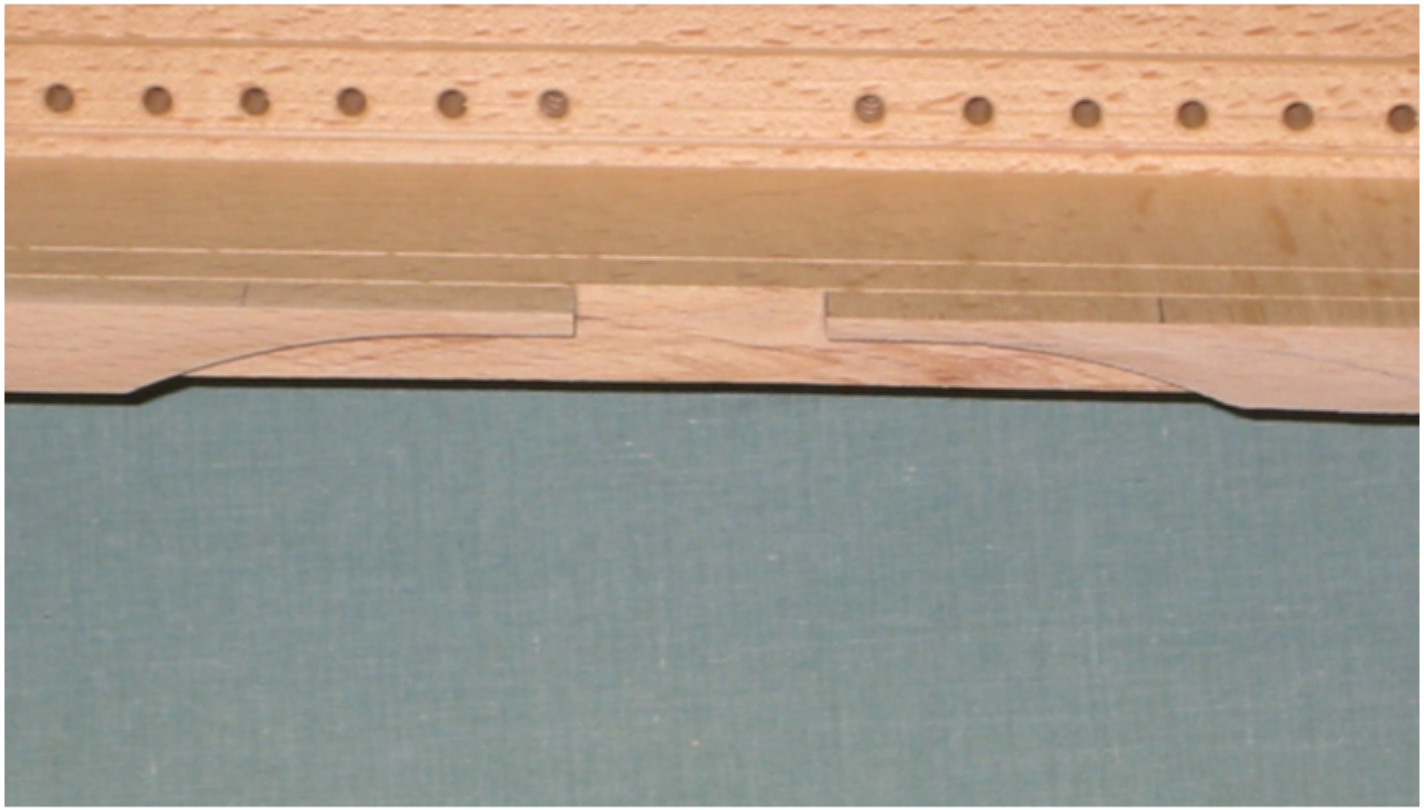
The hole should look like this once the buckskin has been trimmed and the spring installed.

Sostenuto Relief



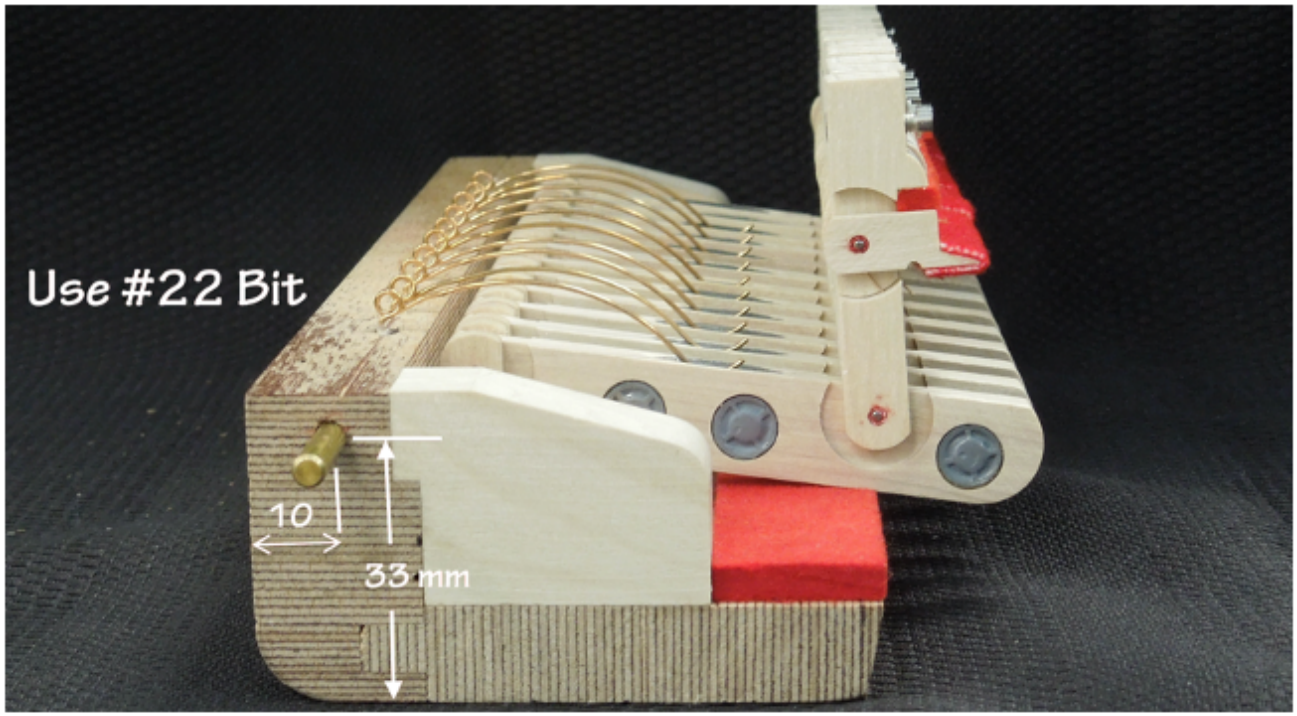
If a sostenuto relief is present, it will likely need to be duplicated. Measure the start and stop locations of the relief, along with the height and depth. Also note the location depth of the notch in the top of the rail. Note that the new tray depth may make this step unnecessary.

Sostenuto Relief



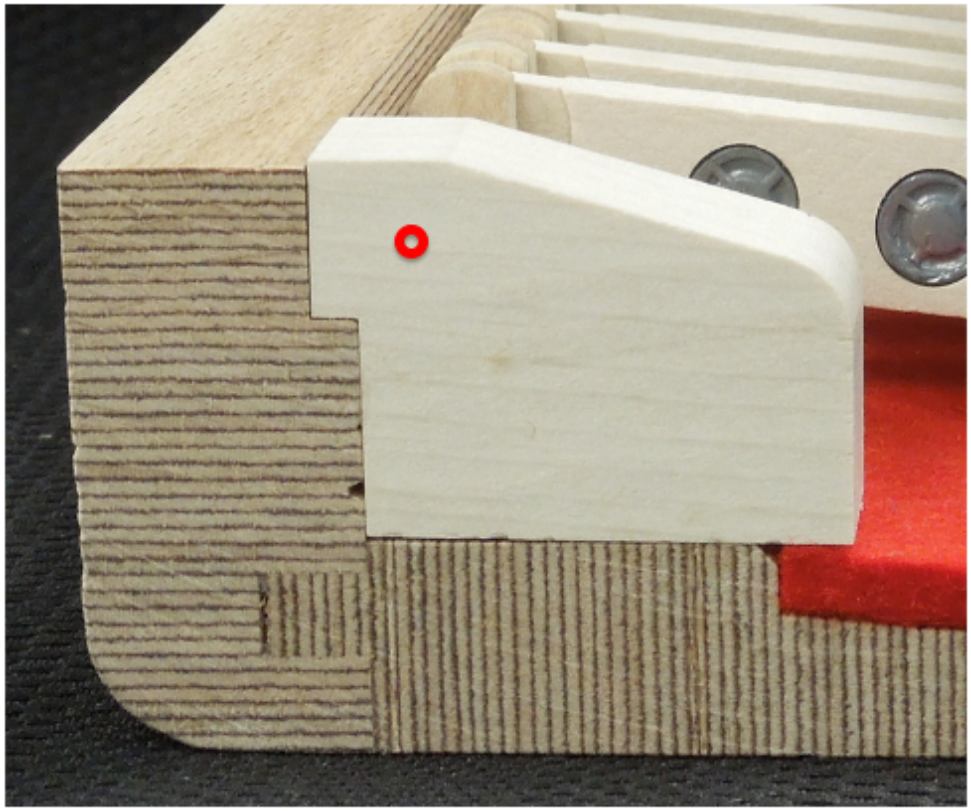
You can duplicate the relief using a backsaw and chisel, or by using a dado blade on the table saw. The result will be as above.

Drill & Install Pivot Pins



Drill the pivot pin holes on each end of the tray using a #22 bit. It is recommended that these holes be drilled at a location that is 10 mm from the back of the tray and 33 mm from the bottom to modernize the pin locations. You may also elect to duplicate the locations from the original tray, which will likely be different. After drilling the pivot pin holes, tap in the pivot pins provided in the kit.

Drill & Install Pivot Pins

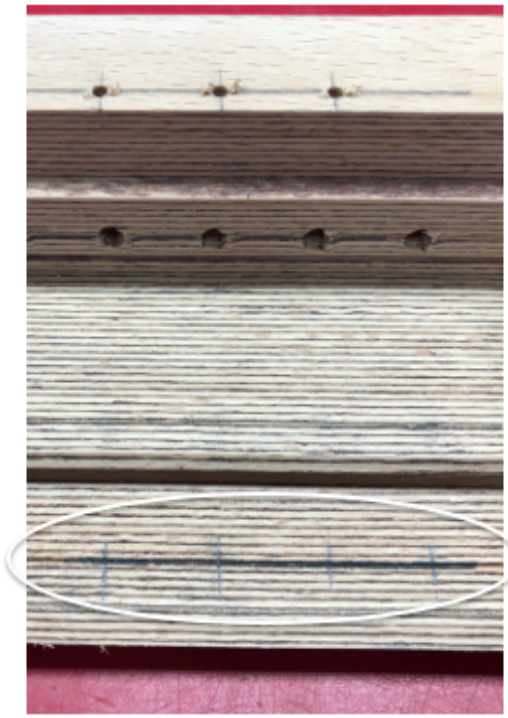


You may alternately elect to place the pivot pins in the end blocks, making them in line with the underlever center pins.

Installations with Capstans in Tray

The following 11 steps are for installations of the ***Baldassin "3-in-1" Underlever System*** with capstans in the tray.

Transfer Drilling Scale



Transfer the drilling scale to the relief on the front edge of the tray.

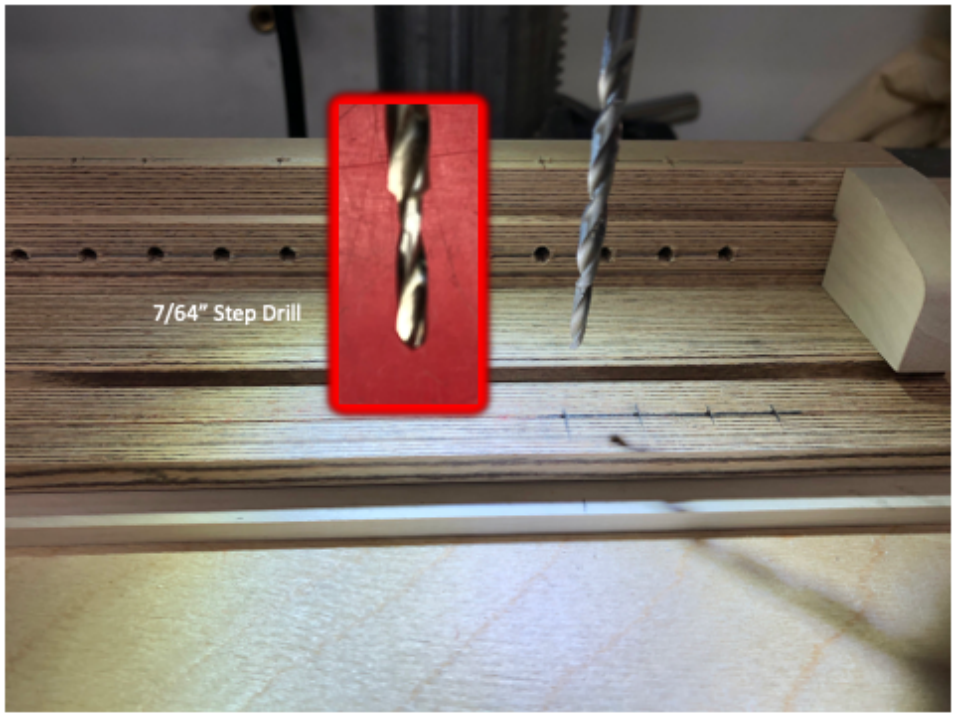
Transfer Drilling Scale

There is a scribe line in the tray along which the capstan holes should be drilled. Mark the drilling locations along the scribe line at each pencil line using an awl or transfer punch.

Make Jig to Drill the Capstan Holes

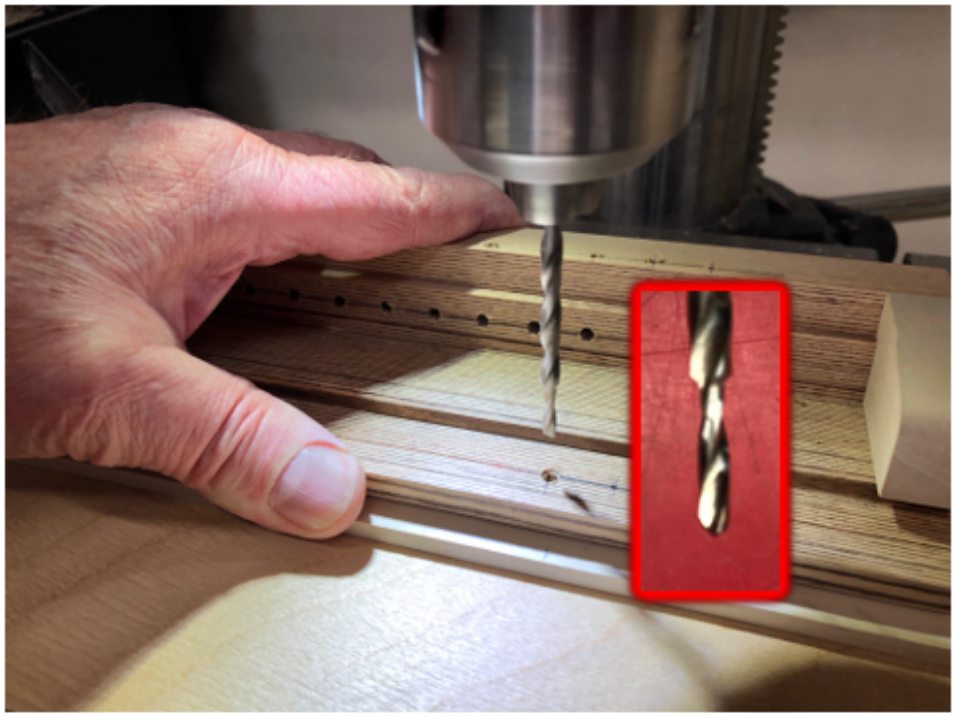
Make a jig that is equipped with a strip that elevates the front of the tray until the relief angle is parallel to the drill table to drill the capstan holes perpendicular to the angle in the relief. This jig should also have a fence that can be aligned so that holes will be drilled along the scribe line in the relief on the front of the tray.

Set Jig to Establish Drilling Line



Set the jig so that the holes will be drilled along the scribe line in the relief on the front of the tray. Drill the capstan holes completely through the tray using a 7/64" step drill (available from Renner USA).

Drill and Countersink in one step with a 7/64" Step Drill



Drill the capstan holes completely through the tray using a 7/64" drill. The bit pictured above is a step drill that drills and countersinks the hole in one procedure (available from Renner USA). If you do not use a step drill, the holes will need to be countersunk prior to capstan installation.

Apply Beeswax to the Capstans

Apply beeswax to the threads of each capstan.

Start Capstans by Hand

Start the capstans into the holes in the tray by hand.

Install Capstans

Using a special Capstan Insertion Tool (available from Renner USA) in the drill press, spin the capstans into the tray using a 3.5 mm (5/32”) spacer to set uniform depth.

Install Capstans

With the drill press spinning, apply pressure until the capstans contact the spacer. When installed, the capstans will protrude through the bottom of the tray as shown above.

Sand Bottom of Tray

Use a belt sander to sand the protruding threaded capstan shafts flush with the bottom of the tray. After sanding, the bottom of the tray should look like this.

Install Action Cloth

For installations with capstans in the tray, glue the action cloth pieces supplied in the kit onto the bottoms of the underlevers so that they are 19 mm (3/4”) from the rear edge on the bottom of the underlever.

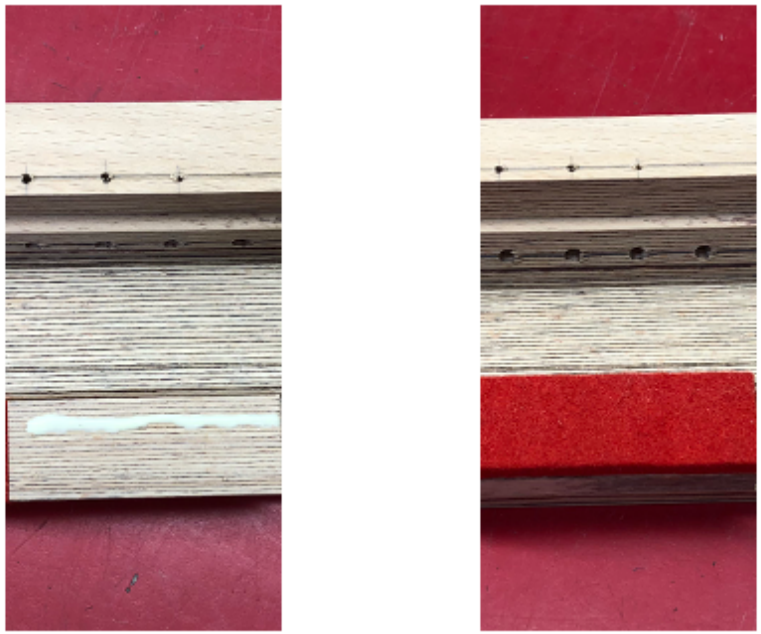
Installations without Capstans

The following 2 steps are for installations of the ***Baldassin "3-in-1" Underlever System*** with no capstans

Install Wooden Shim

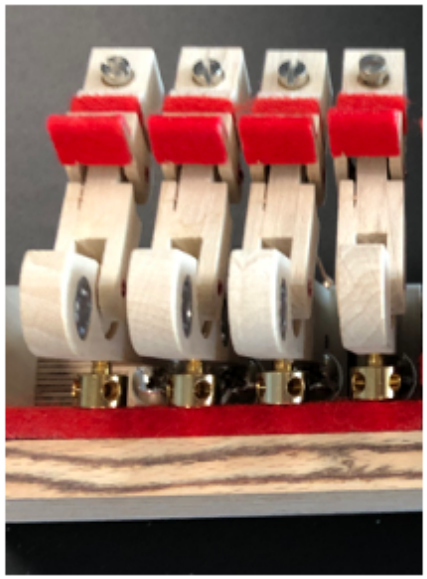
Cut and glue the wooden shim provided in the kit into the relief on the front edge of the tray.

Install Tray Cushion Felt



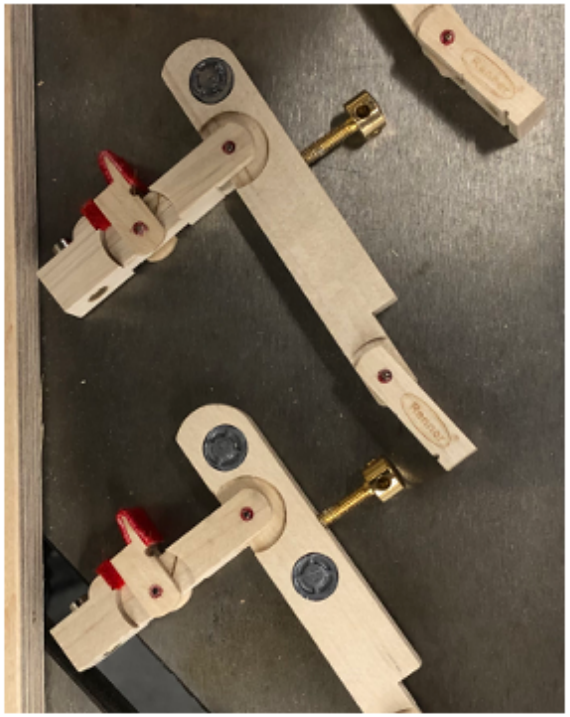
Install the tray cushion felt. Apply glue only under the rear half of the felt, as shown above. This leaves the front half unglued, allowing shims to be installed, if necessary. Apply light pressure to the felt until the glue is set.

Installations with Capstans in the Underlevers



The following 3 steps are for installations of the ***Baldassin "3-in-1" Underlever System*** with capstans in the underlevers.

Apply Beeswax to the Capstans

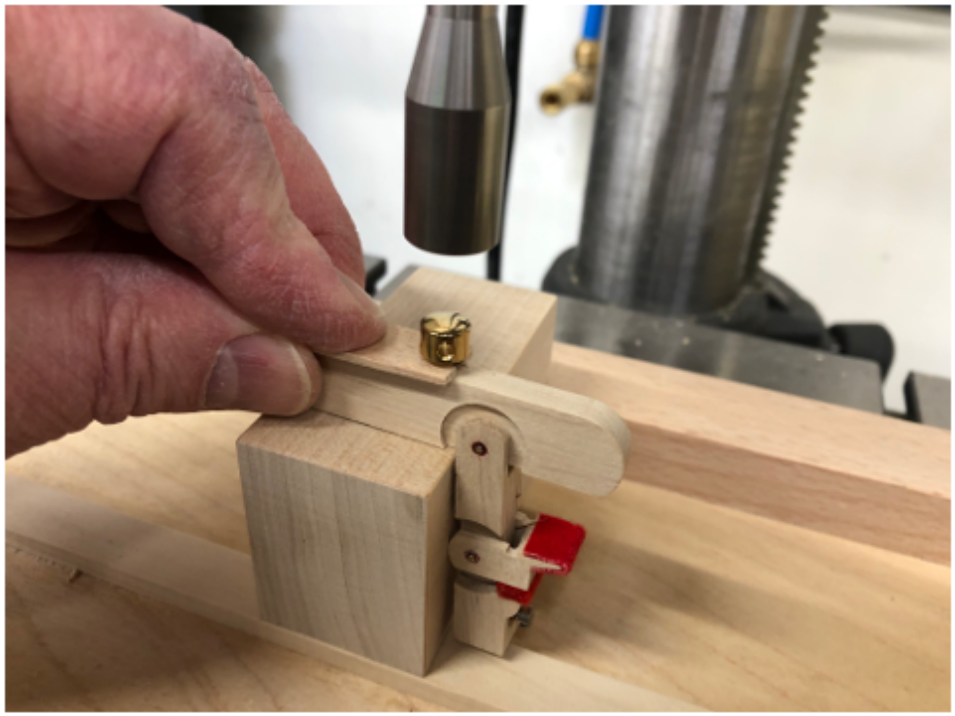


Apply beeswax to the threads of each capstan and start the capstans into the holes in the bottoms of the underlevers by hand.

Install Capstans Into the Underlevers

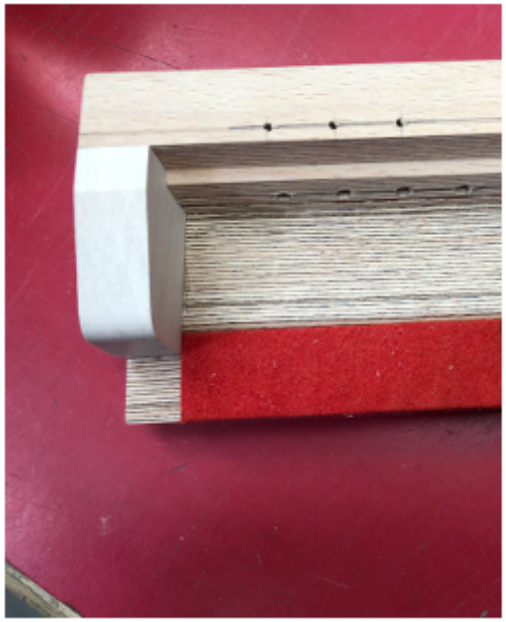
Use a block to support the underlever as shown above. Place the underlever with the capstan started by hand and spacer in position under the spinning Capstan Insertion Tool (available from Renner USA).

Install Capstans Into the Underlevers



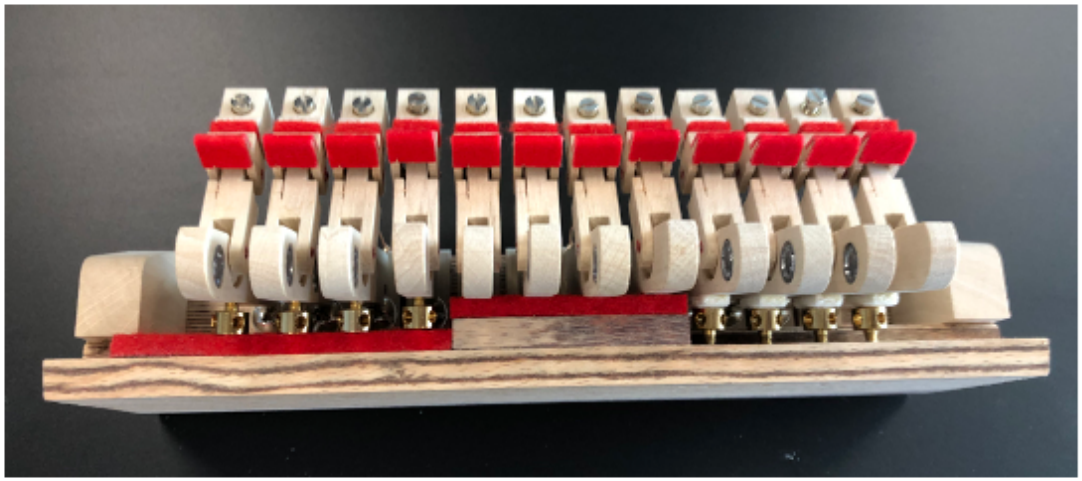
Using the drill press, spin the capstans into the underlevers using a 2mm (5/64”) spacer to set uniform depth.

Install Tray Cushion Felt



When installing the tray cushion felt, apply glue only under the rear half of the felt, as shown above. Apply light pressure to the felt until the glue is set.

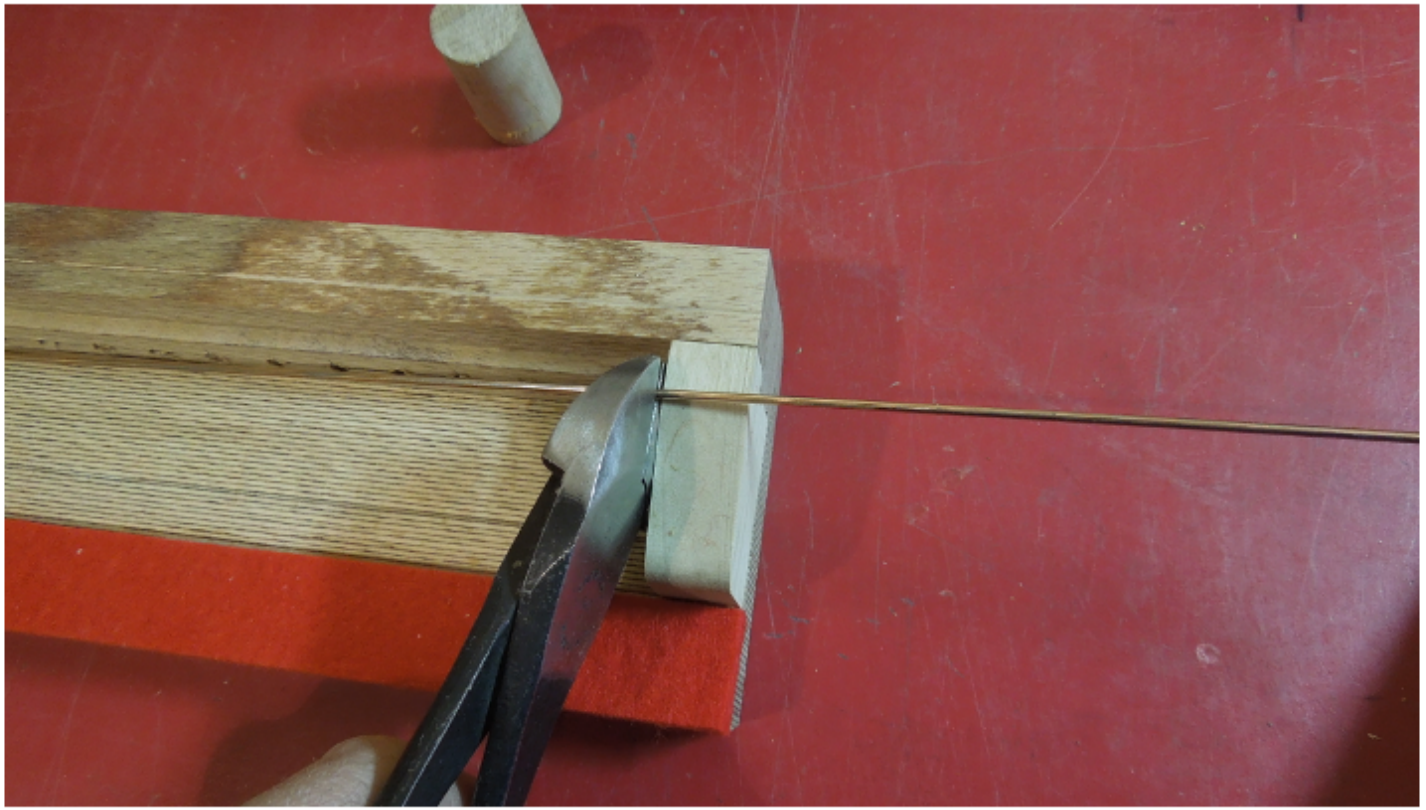
All Installations



Capstans in the Underlevers | No Capstans | Capstans in the Tray

The remaining steps apply to all installations of the ***Baldassin "3-in-1" Underlever System*** by Renner USA.

Cut Flange Keeper Wire



Cut the flange keeper wire to length and place it in the groove located below the flange screw holes BEFORE the flanges are installed.

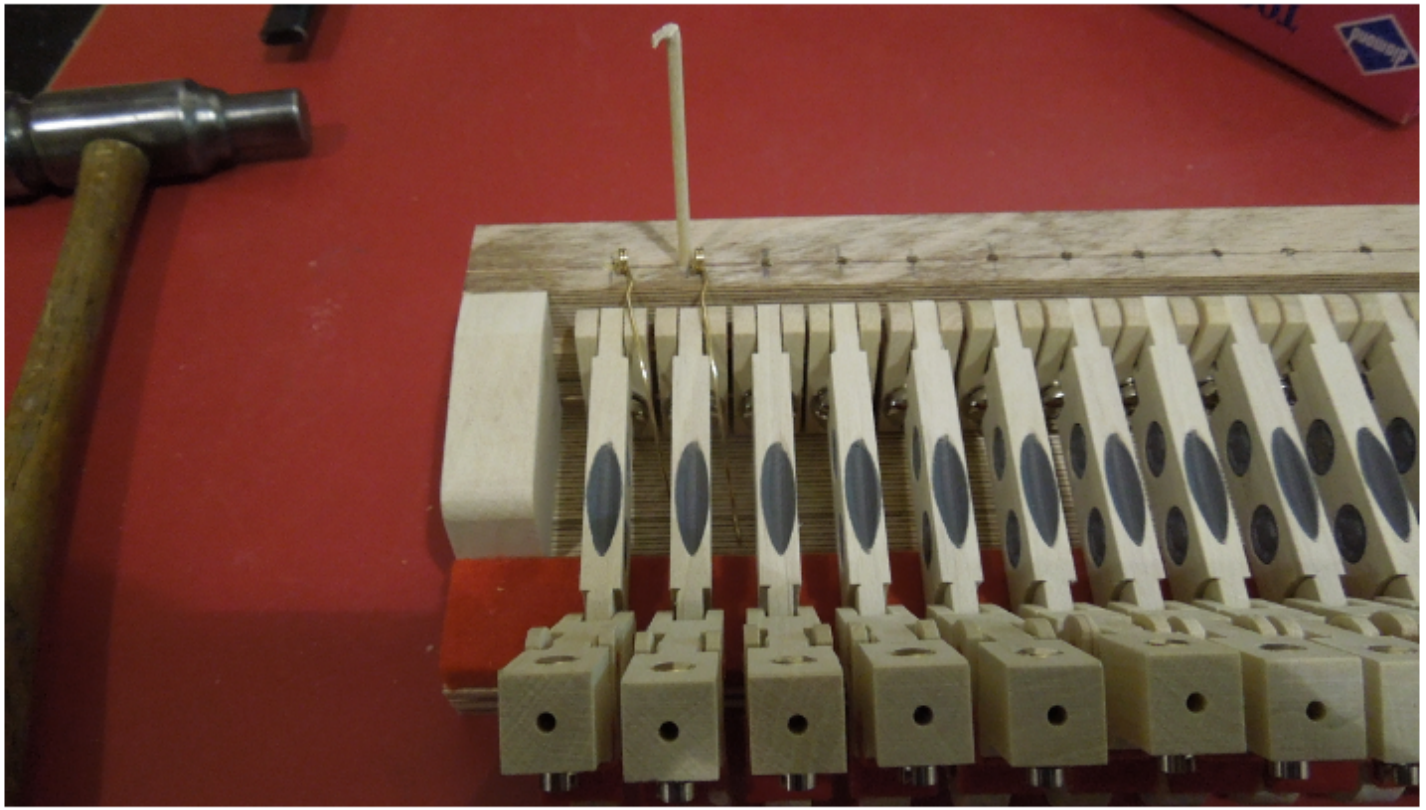
Install Underlevers

Install the underlevers onto the tray, starting with the underlevers with 3 leads in the bass, then 2 leads, 1 lead, and finally no leads at the treble end. The distribution of leads may not match the original leading pattern. The flange screws have a special head that looks similar to a Phillips head, called Pozidrive, and is labeled PZ2. Be sure to use a PZ2 screwdriver or bit when installing the screws. Using a Phillips head screwdriver or bit will damage the screw heads.

Check Spacing on Keys

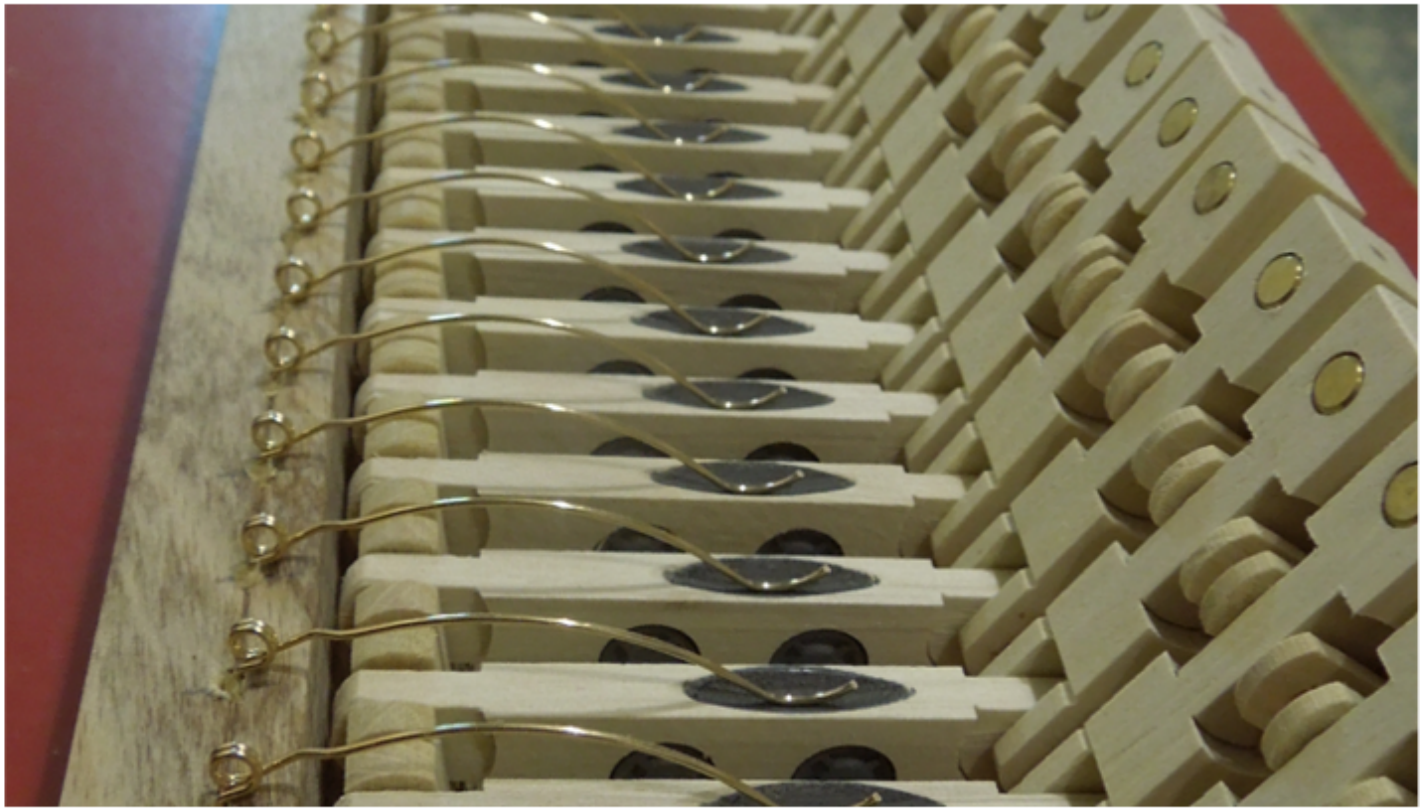
With the underlevers installed on the tray, check the spacing over the backs of the keys and make any adjustments necessary.

Install Springs



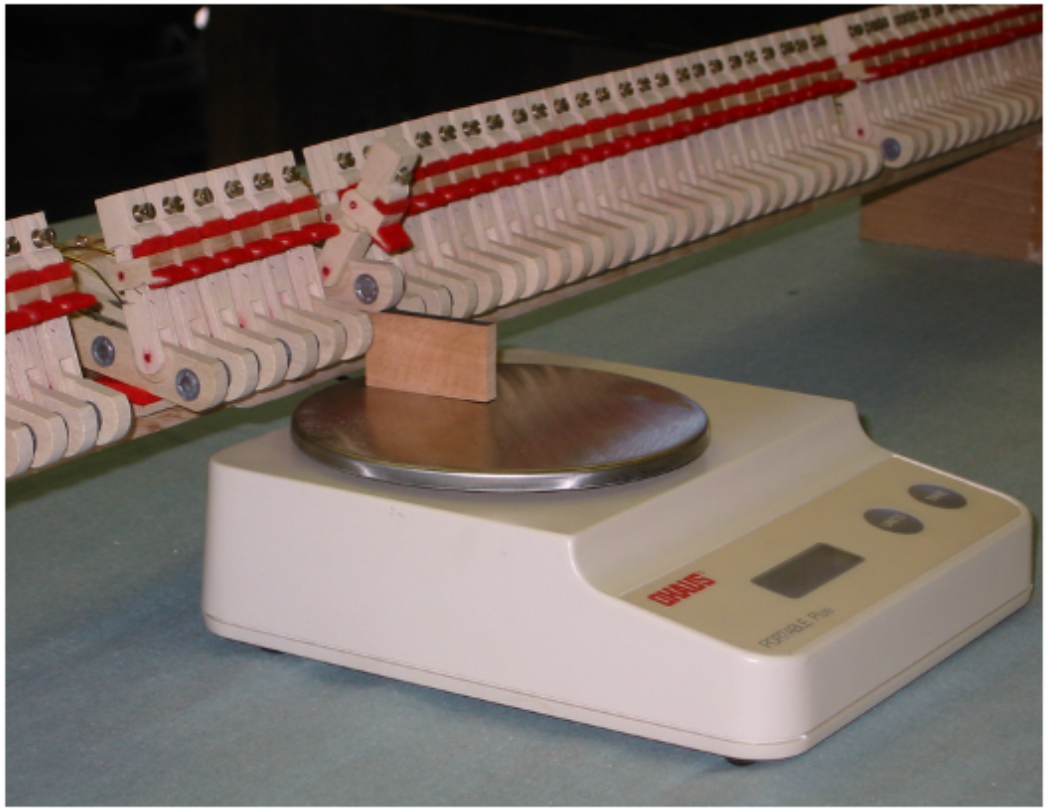
If springs are being used, they should be installed at this point. Place the spring into the hole and secure it in place using a round toothpick with a spot of glue on it. Once the toothpick is driven into place, break off the toothpick by bending it towards the bass end of the tray. Some underlever systems were equipped with springs while others were not. The number of springs used also varied. You decide whether or not to use springs and if so, how many.

Installed Springs



Once the springs are installed, place the springs into the grooves in the underlevers.

Regulate Spring Tension

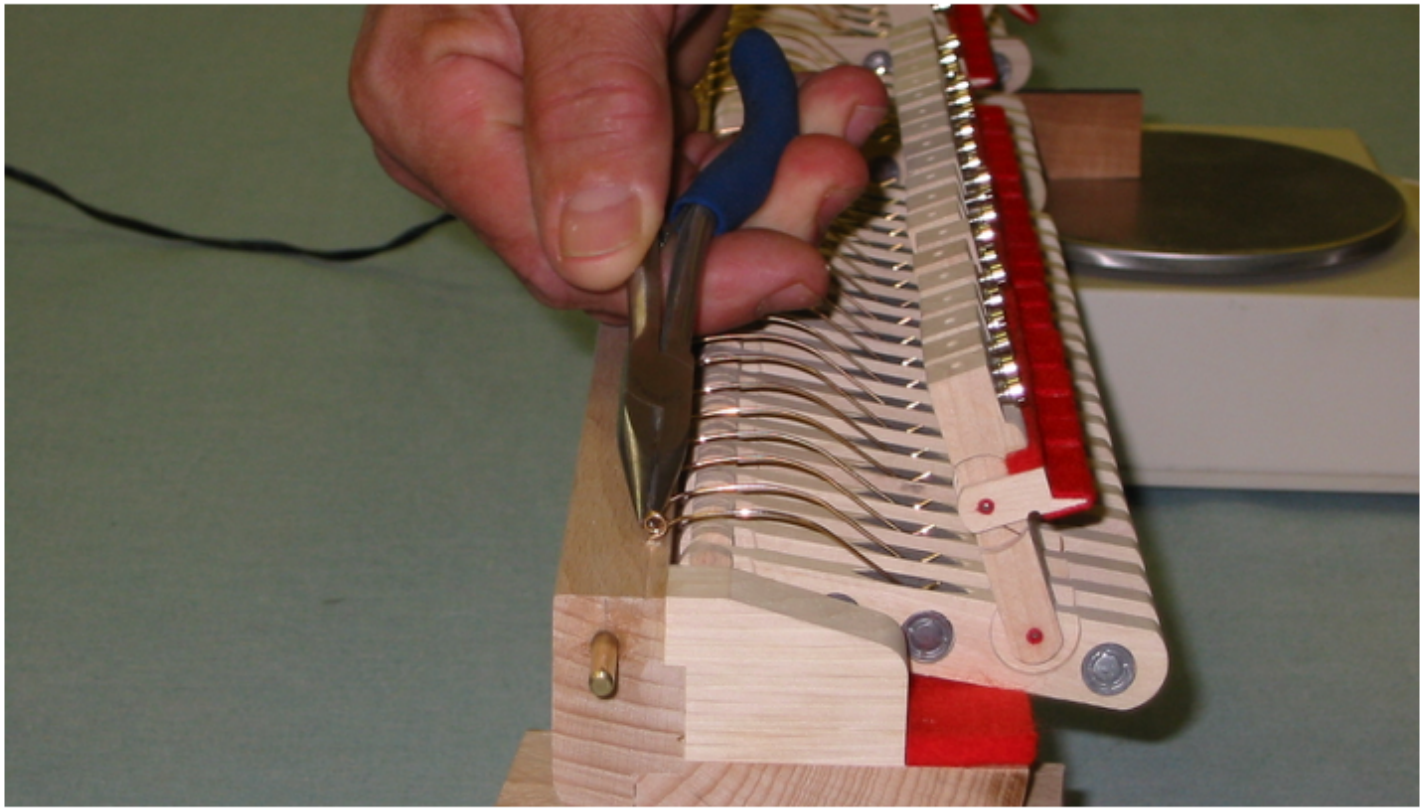


The spring tension must be regulated for proper feel. A digital scale is used to measure the spring strength. To regulate the spring tension, place wooden blocks of equal height under the tray ends to raise the tray to a sufficient height above the scale. Use a small block of wood on the digital scale to raise the underlever being measured to horizontal. The measurement should be made with the top post leaning forward, as pictured above.

Regulate Spring Tension

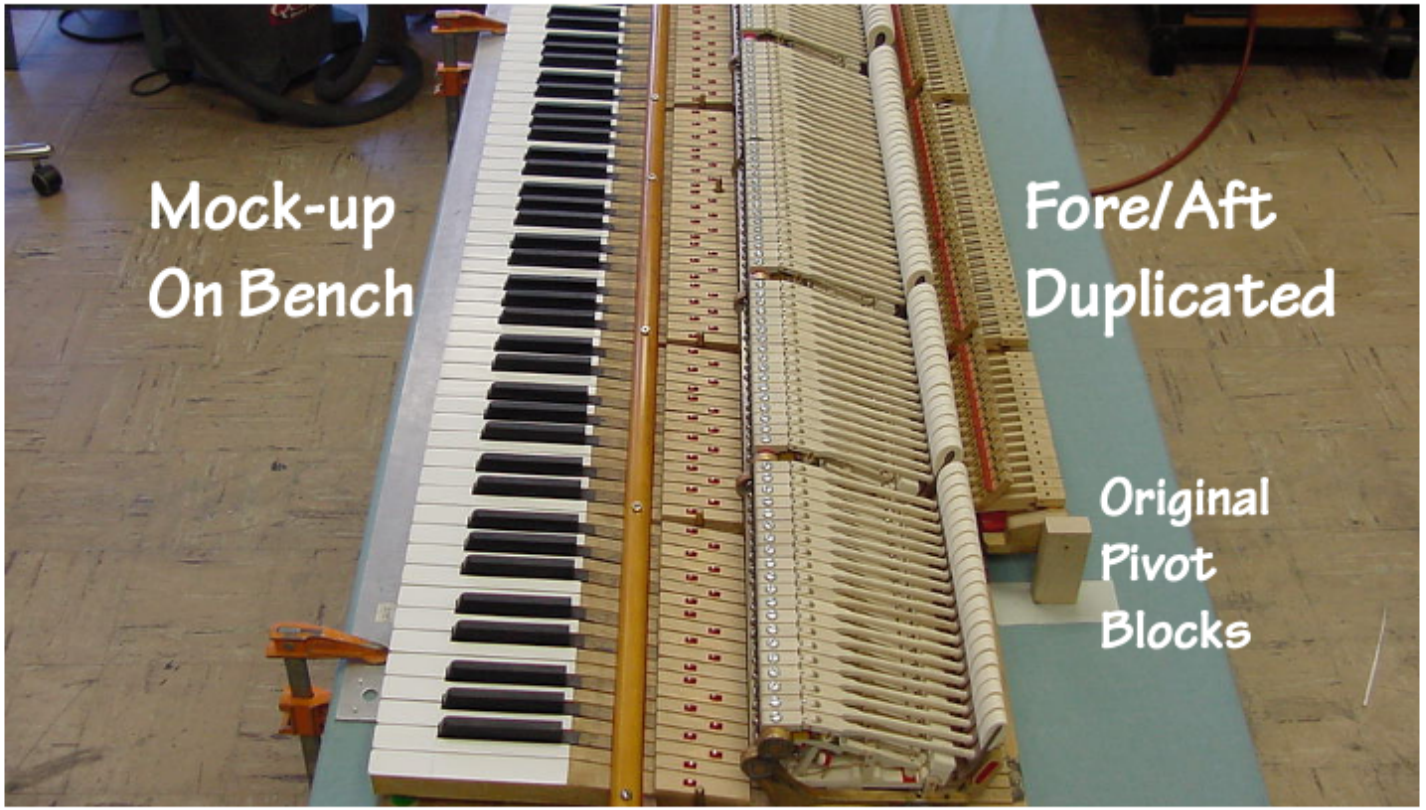
The spring tension, measured in grams, is not absolute, but typically ranges from the high 20s in the bass, decreasing to the low 20s in the treble. The graduation from the bass end to the treble end should be as smooth as possible.

Regulate Spring Tension



Use round nose pliers inserted into the spring coils to adjust the spring tension. Twist to the rear to decrease the tension, and to the front to increase the tension.

Location Theory 101

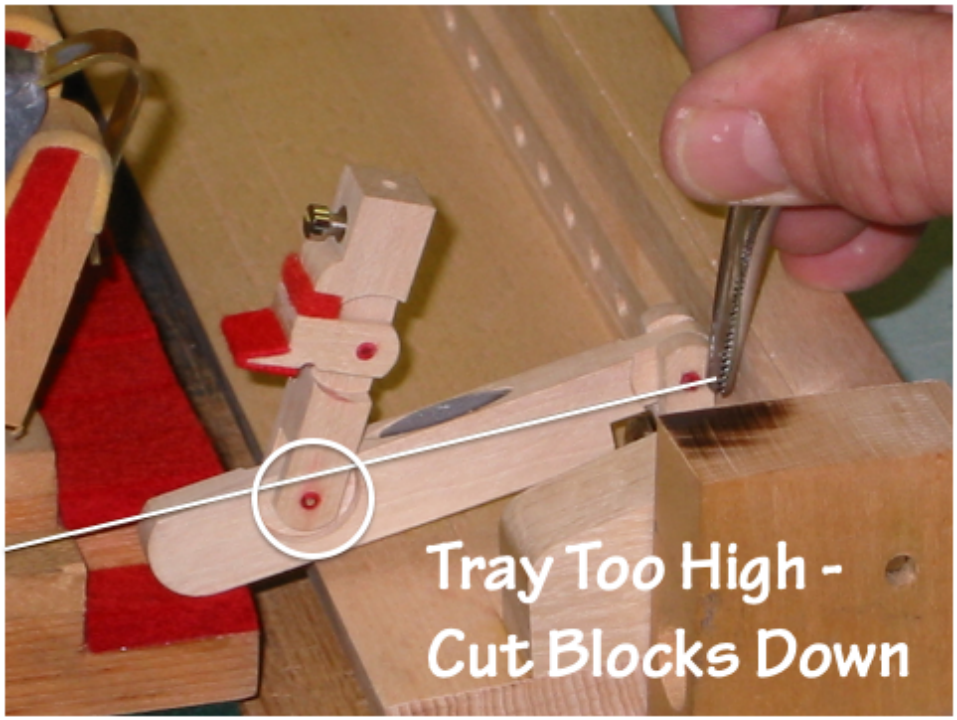


At this point, the location of the damper action in relation to the action in the piano must be duplicated on the workbench for evaluation. Measure from the back of the action cavity to the front of the keyframe at both ends of the damper action and duplicate these dimensions on the bench. Secure the action in position and place the damper action over the key ends using the original pivot blocks.

Location Theory 101

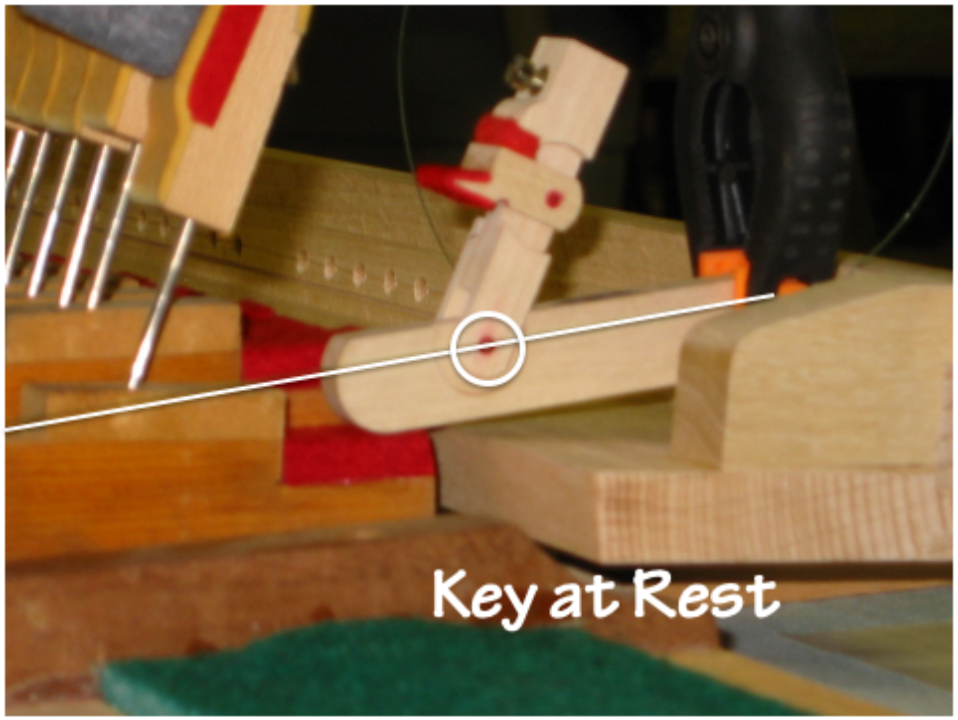
Draw a string from the key balance pin at the bottom of the key to the underlever center pin, as shown above.

Location Theory 101



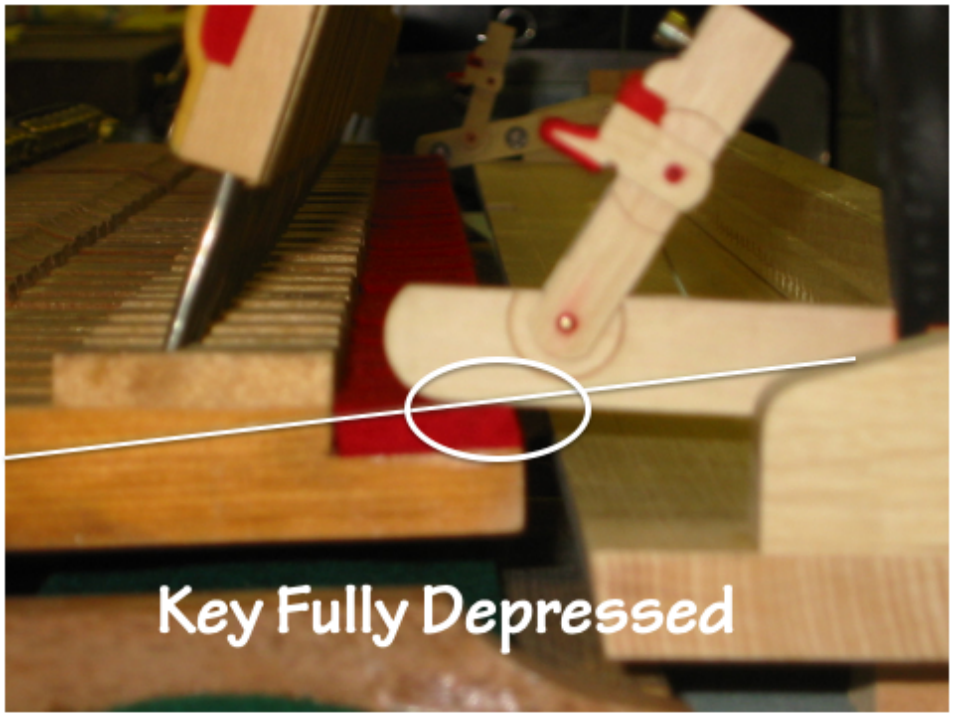
If the top post center pin is below the line, as pictured above, then the tray is too high, and the pivot blocks will need to be cut down.

Location Theory 101



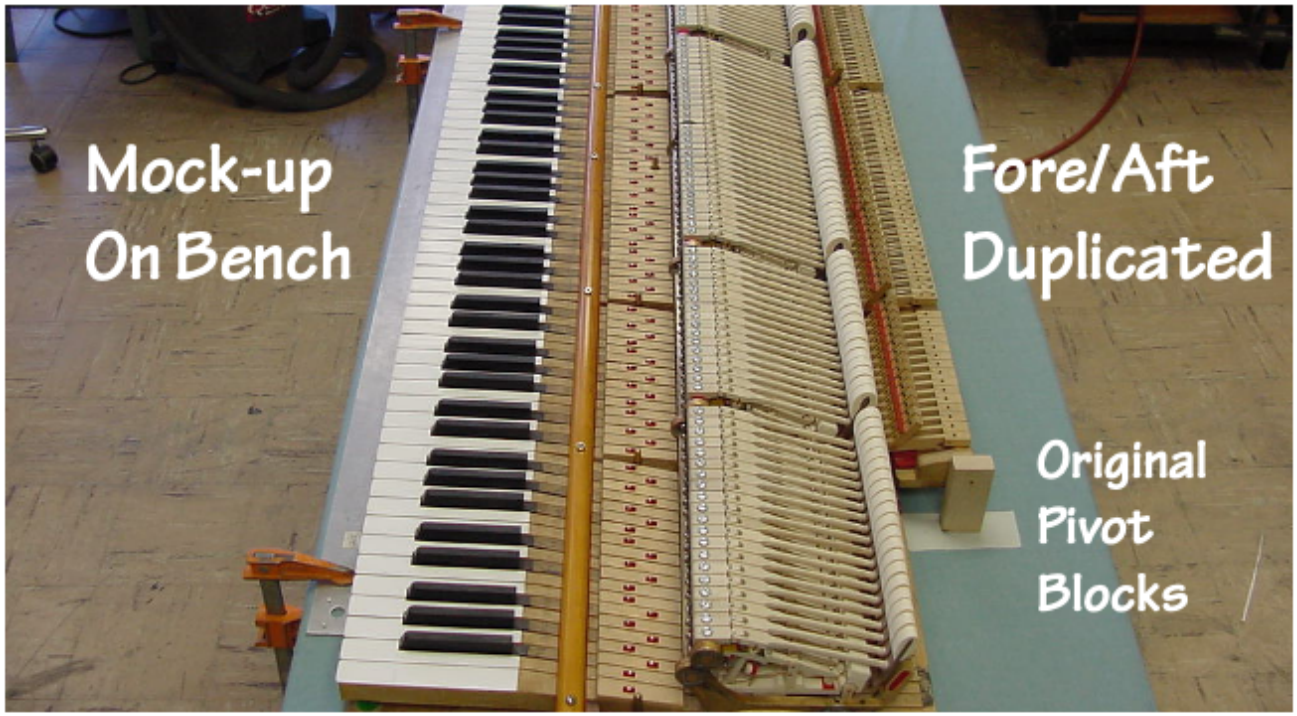
With the key at rest, the top post center pin should be on the line.

Location Theory 101



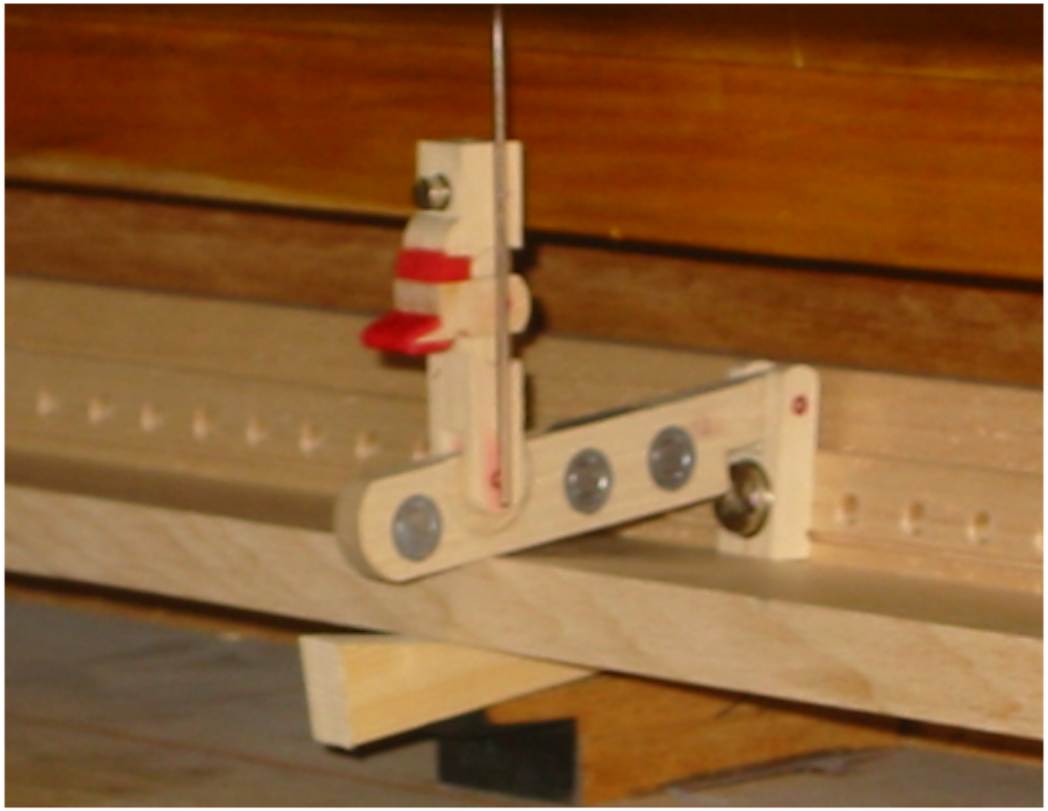
With the key fully depressed, the intersection of the underlever and the key end felt should be on the line. When the action is positioned like this, sliding friction is minimized and vertical movement is maximized. If you look at the picture above, however, you will see that due to space constraints, the underlever has rotated past horizontal, which is not desirable. Now that the location theory has been presented, a simplified method for locating the new damper action will be presented.

Damper Action Location
A Simplified Approach



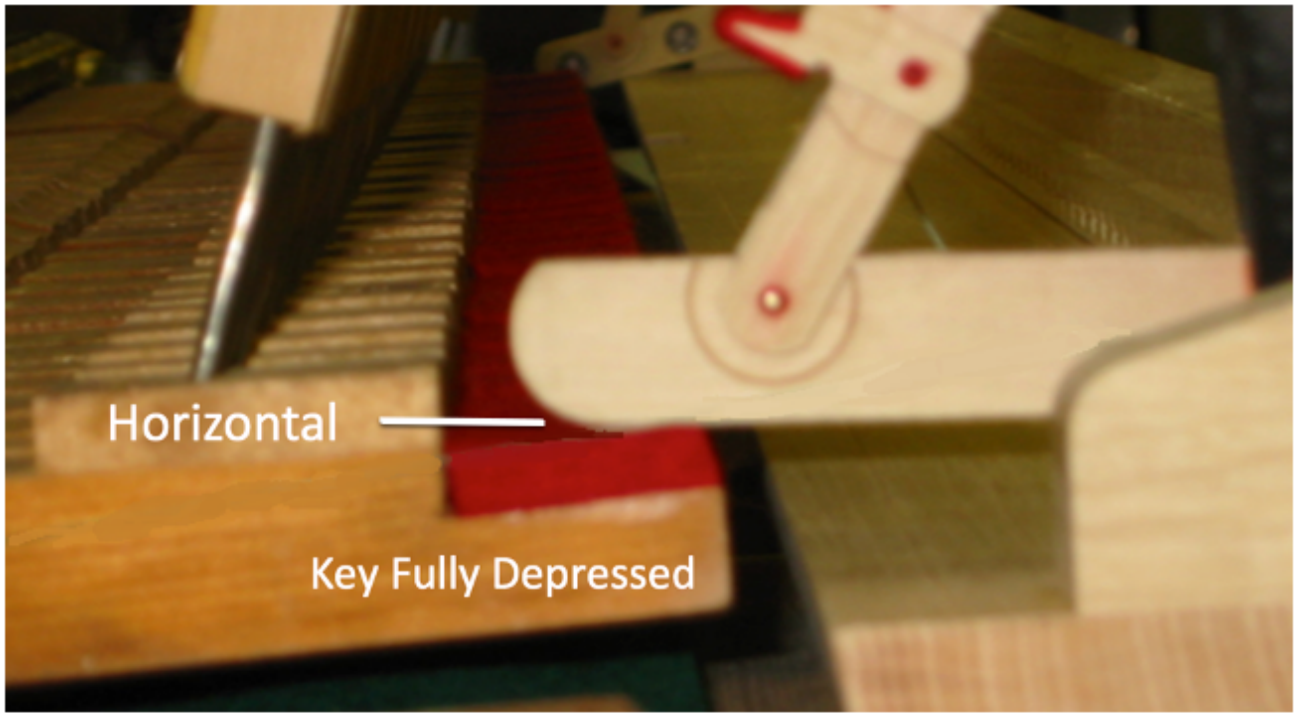
Space limitations often limit the ability to locate the damper action according to the theory. The following simplified approach will allow the damper action to be placed as best possible within these limitations.

Fore/Aft Location Simplified



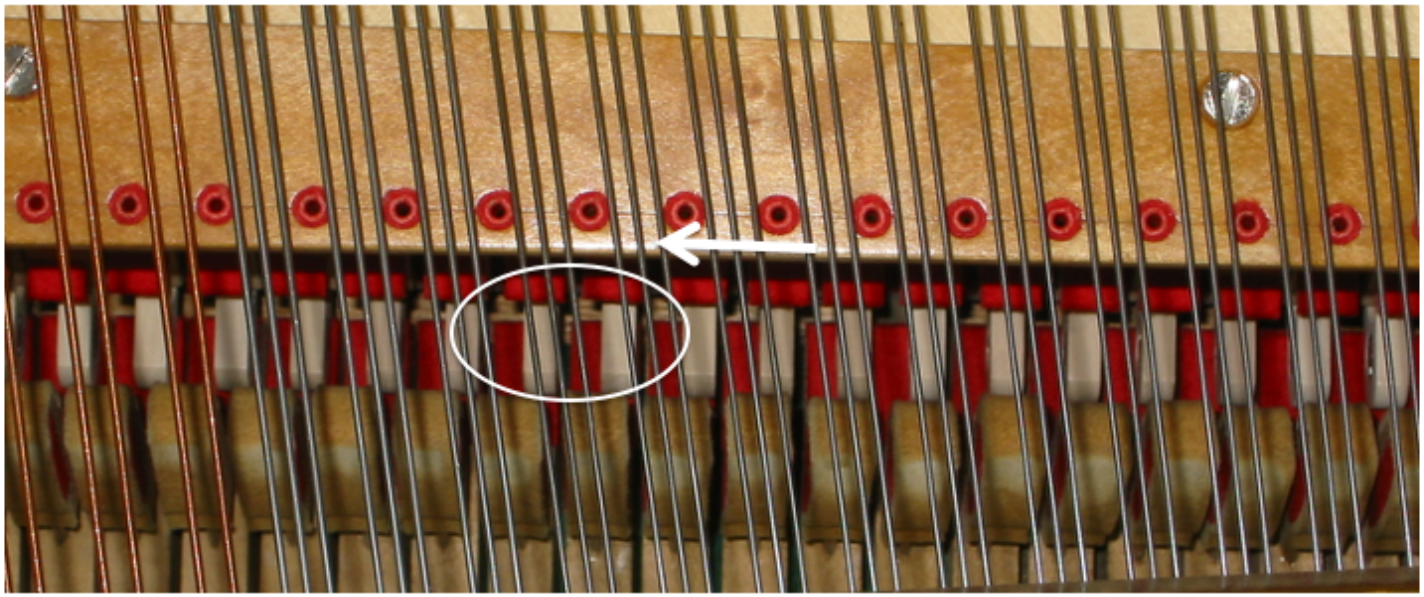
The damper top post should be located fore/aft so that it is located directly below the damper guide rail hole, as pictured above, if possible. You can confirm this placement by hanging a small weight attached to a string from the guide rail hole. This is the proper fore/aft position of the damper action. Space constraints sometimes prevent the proper fore/aft location. In this case, you should attempt to locate the position as close to the ideal as possible, within these constraints.

Tray Height Simplified



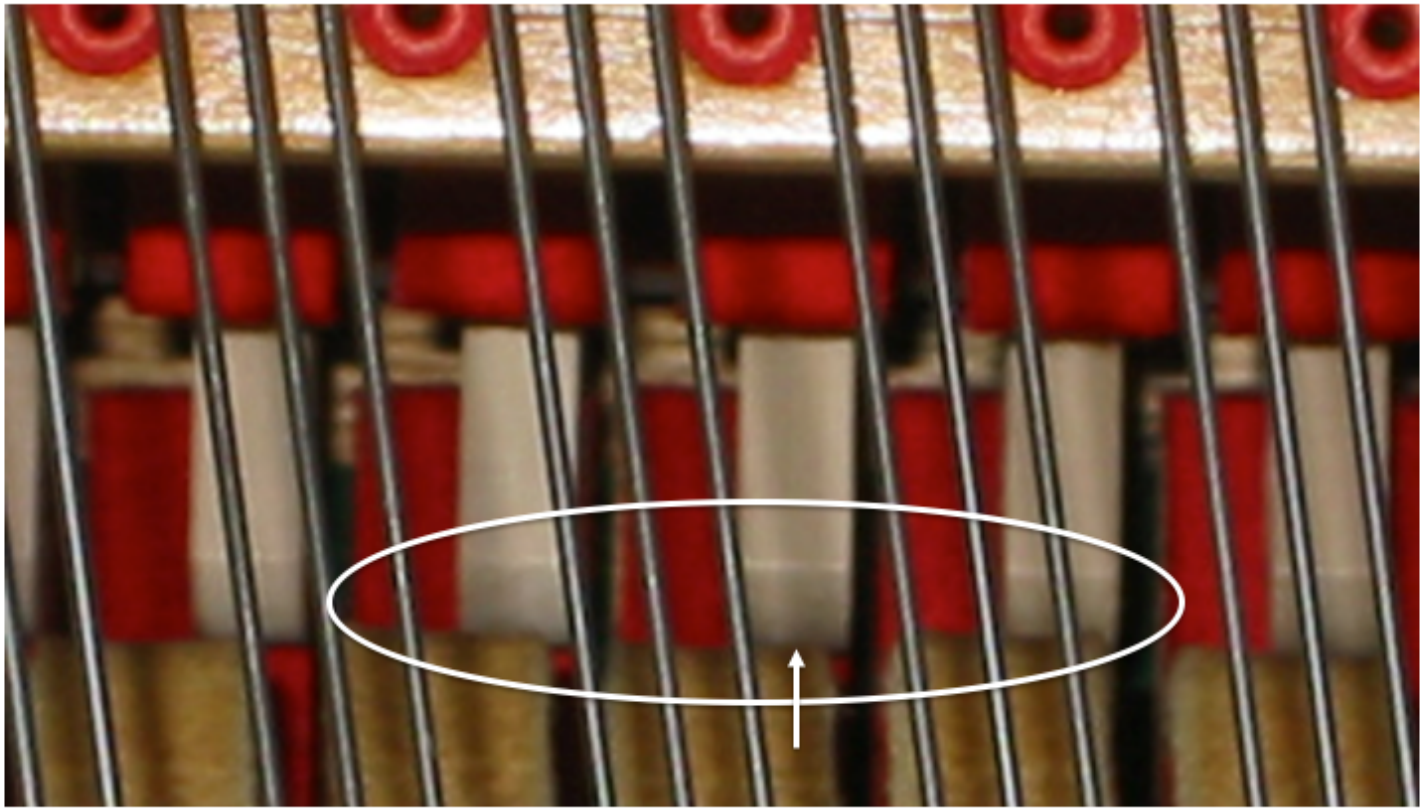
The tray height should then be raised or lowered until the underlever is horizontal when the key is fully depressed with the key travel set, as pictured above.

Lateral Position



The side-to-side position of the damper action should be adjusted until the treble sides of the underlevers are roughly flush with the treble sides of the key ends. In the picture above, the damper action is located too far to the treble side and should be moved towards the bass. This would be accomplished by reducing the thickness of the the punchings at the bass pivot pin and increasing the thickness of the punchings at the treble pivot pin.

Confirm Fore/Aft Position

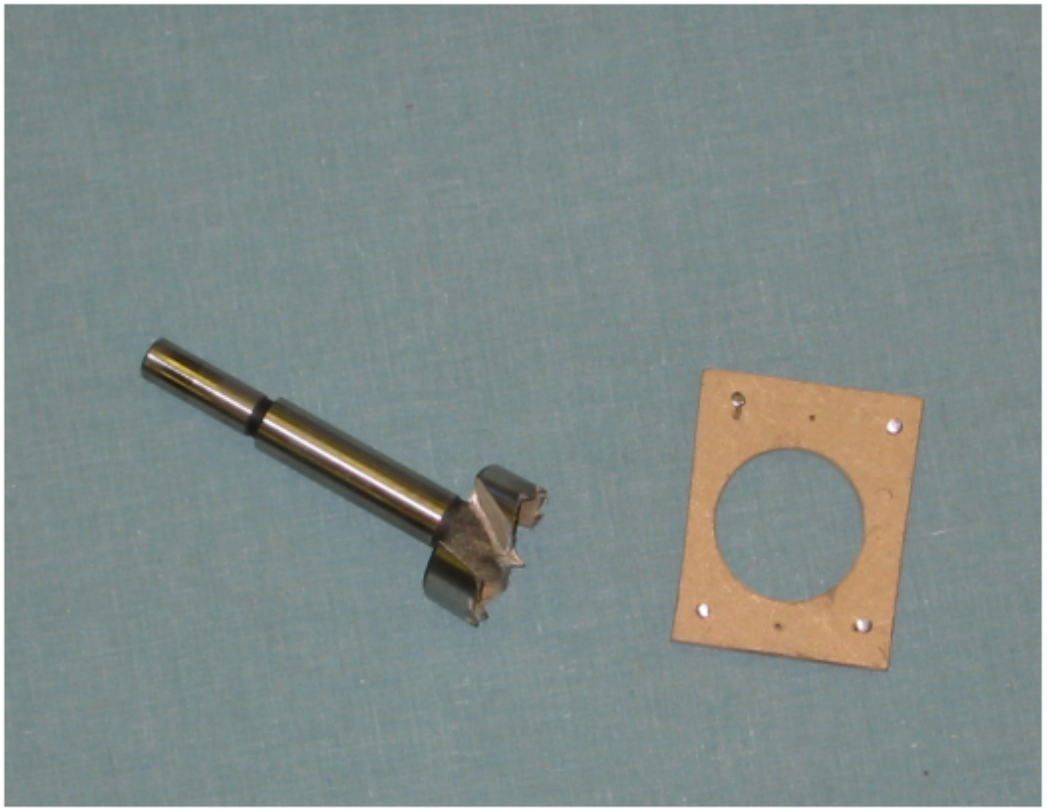


The fore/aft position should be confirmed in the piano. In the picture above, the underlevers are too far forward and extend beyond the key end felts. This would need to be corrected by removing wood from the backs of the pivot blocks.

Modify or Make New Pivot Blocks

Modify the existing pivot blocks or make new blocks to position the tray as described. If you choose to use the old blocks and need to remove wood from the bottoms of the blocks to lower the tray, be sure to glue a shim of the appropriate thickness to each pivot block so that the blocks are held firmly in position in the cavity. At this point, the tray is properly located.

Modify/Adapt Pitman

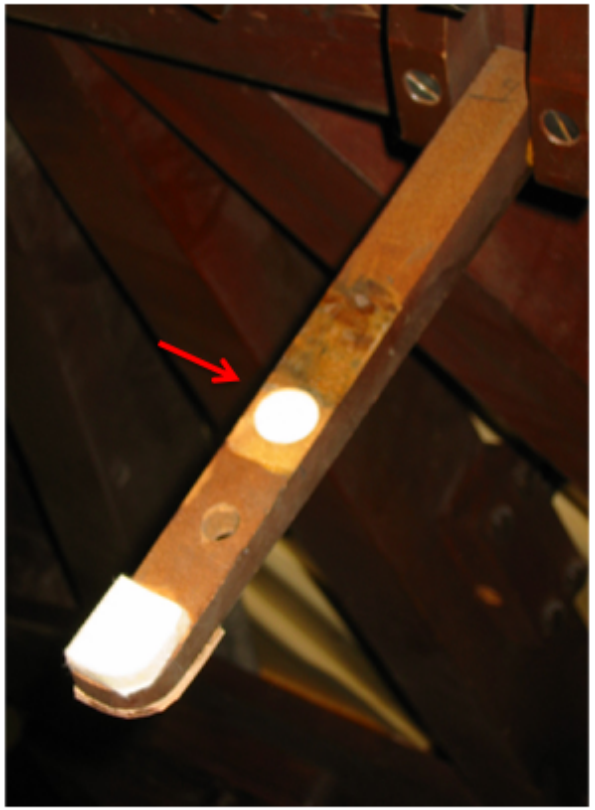


If the piano does not have a free-floating pitman, modifying the system is recommended. To accomplish this modification, you will need a 1-1/4” Forstner bit and a locating block drilled with a 1-1/4” hole and tacks to secure it to the keybed.

Modify/Adapt Pitman

Secure the locating block to the bottom of the keybed with the tacks, centering the hole in the block over the original hole in the keybed, and drill out the hole in the keybed using a 1-1/4” Forstner bit. Be sure to secure the top of the keybed to prevent breakout.

Modify/Adapt Pitman



The trap lever will have a piece of leather that contacted the old pitman. Wear in the leather will indicate where the pitman was located. Mark the center of the pitman location using an awl and then remove the leather. Drill a 5 mm deep hole at this location using a 3/4” Forstner bit.

Modify/Adapt Pitman

Mark the pitman location on the new tray with an awl. You can duplicate the location from the old tray or mark the desired location with the new tray in the piano.

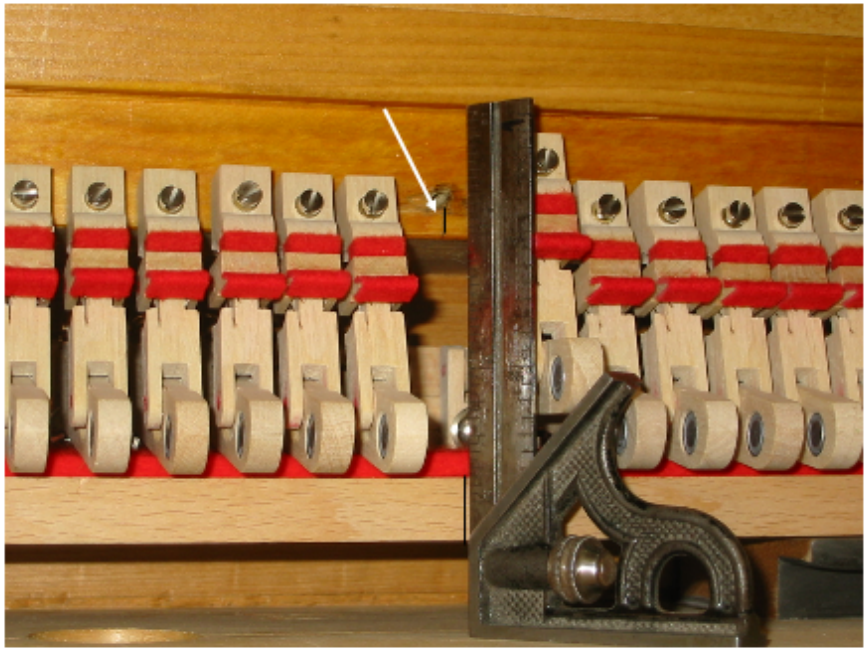
Modify/Adapt Pitman

Drill a hole at this location that is 5 mm deep using a 3/4” Forstner bit.

Modify/Adapt Pitman

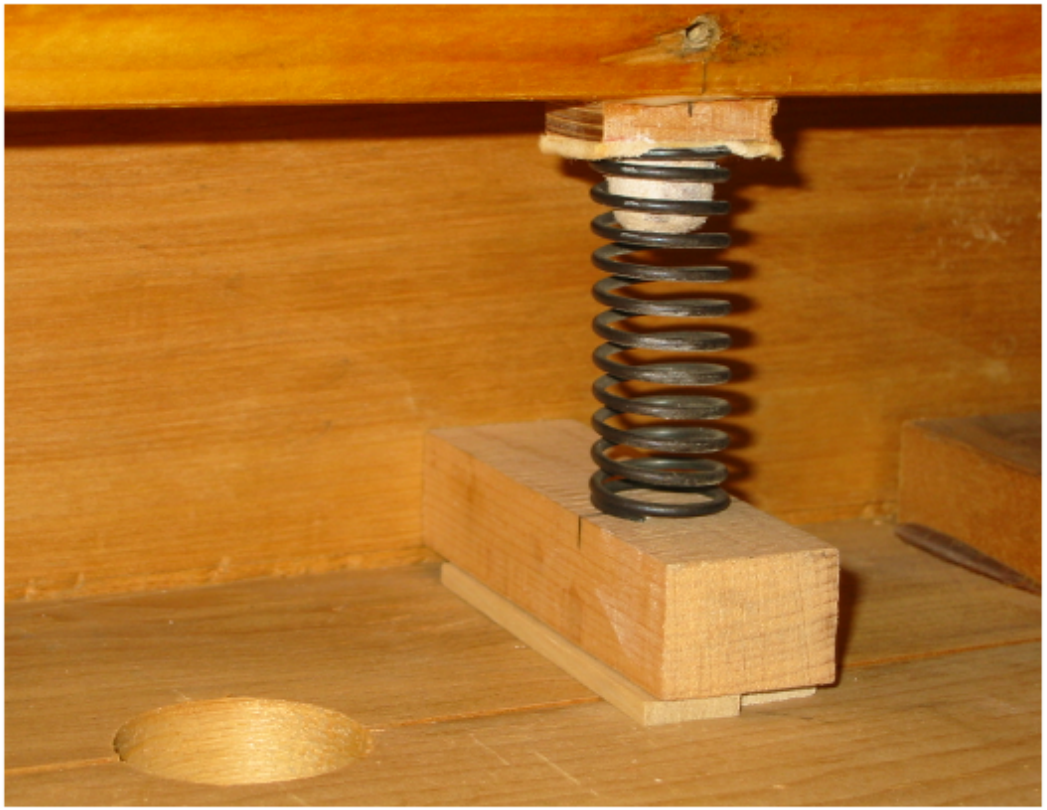
Create a dowel with a threaded rod in the middle to determine the length of the new pitman, as shown above. Insert ¾" diameter pieces of hard felt or back rail cloth into the holes in the trap lever and tray, place the pitman into location, and adjust the length of the pitman until the desired lost motion in the pedal is achieved. (Be sure adjustment on the pedal rod, if present, is in a nominal position first). Once the length is determined, cut a 7/16" dowel to this length and glue the felt punchings to the dowel.

Mark Spring Post Location



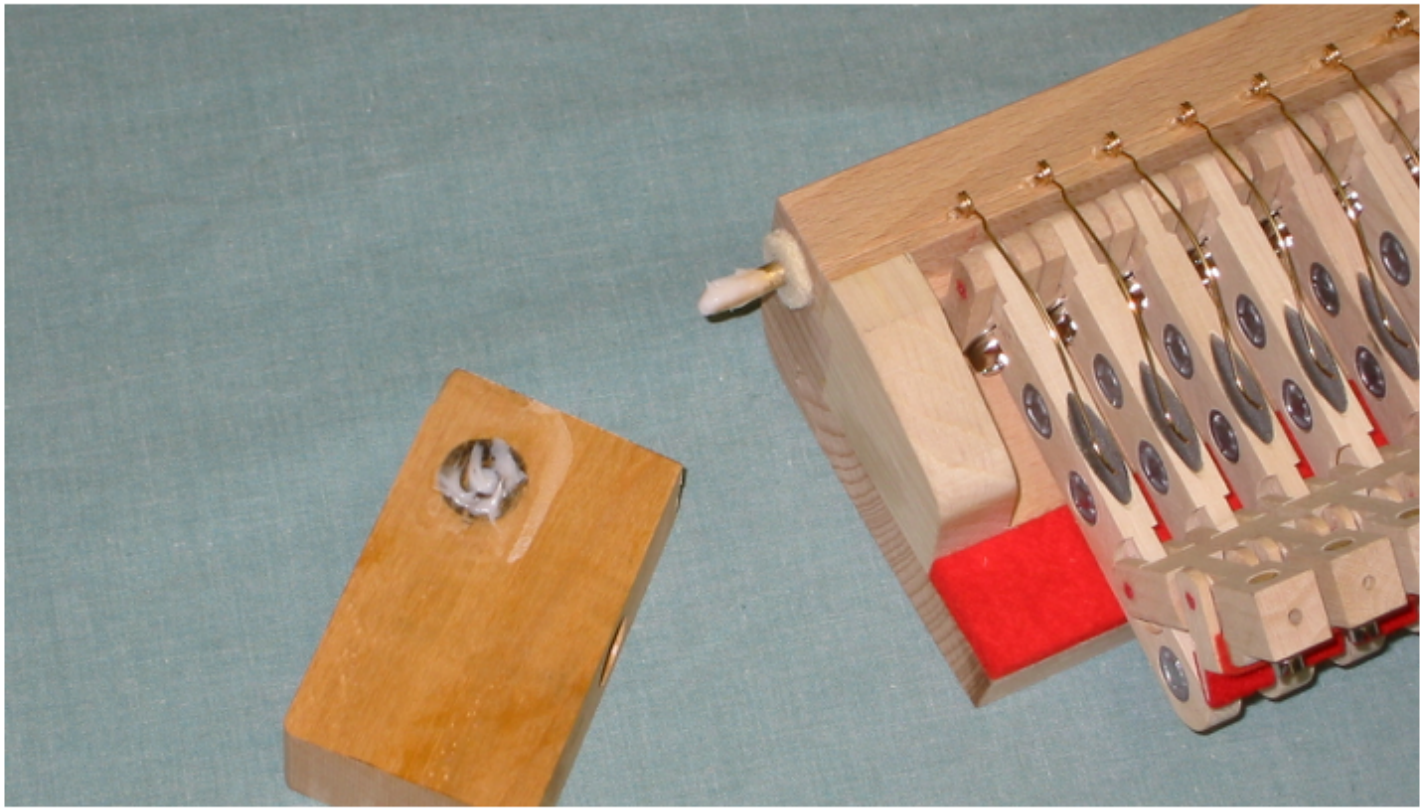
You are now ready to install the tray return spring. Mark the location for the spring post in the piano from the tray.

Glue In Spring Post



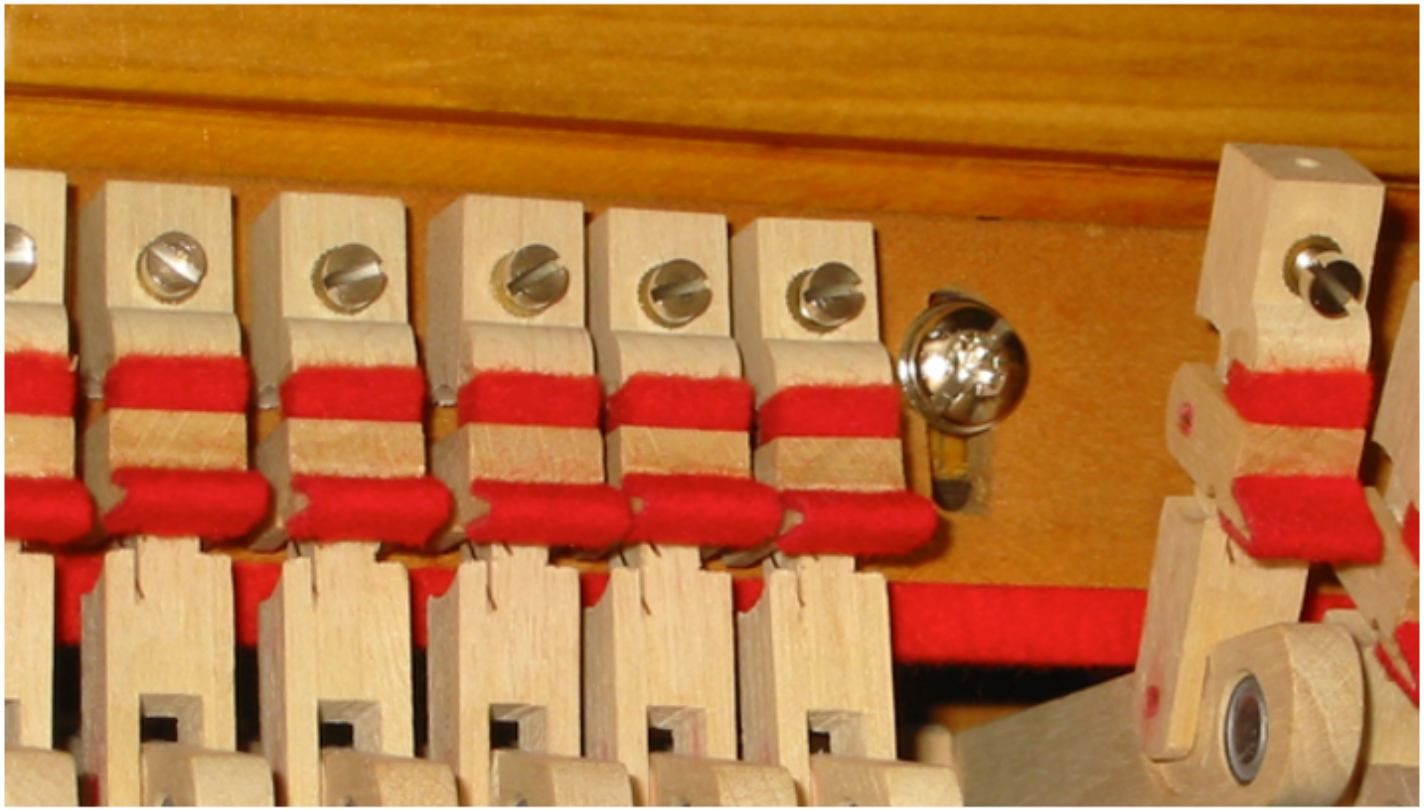
Glue the spring post into position using the spring and blocks of wood as a clamp.

Install New System



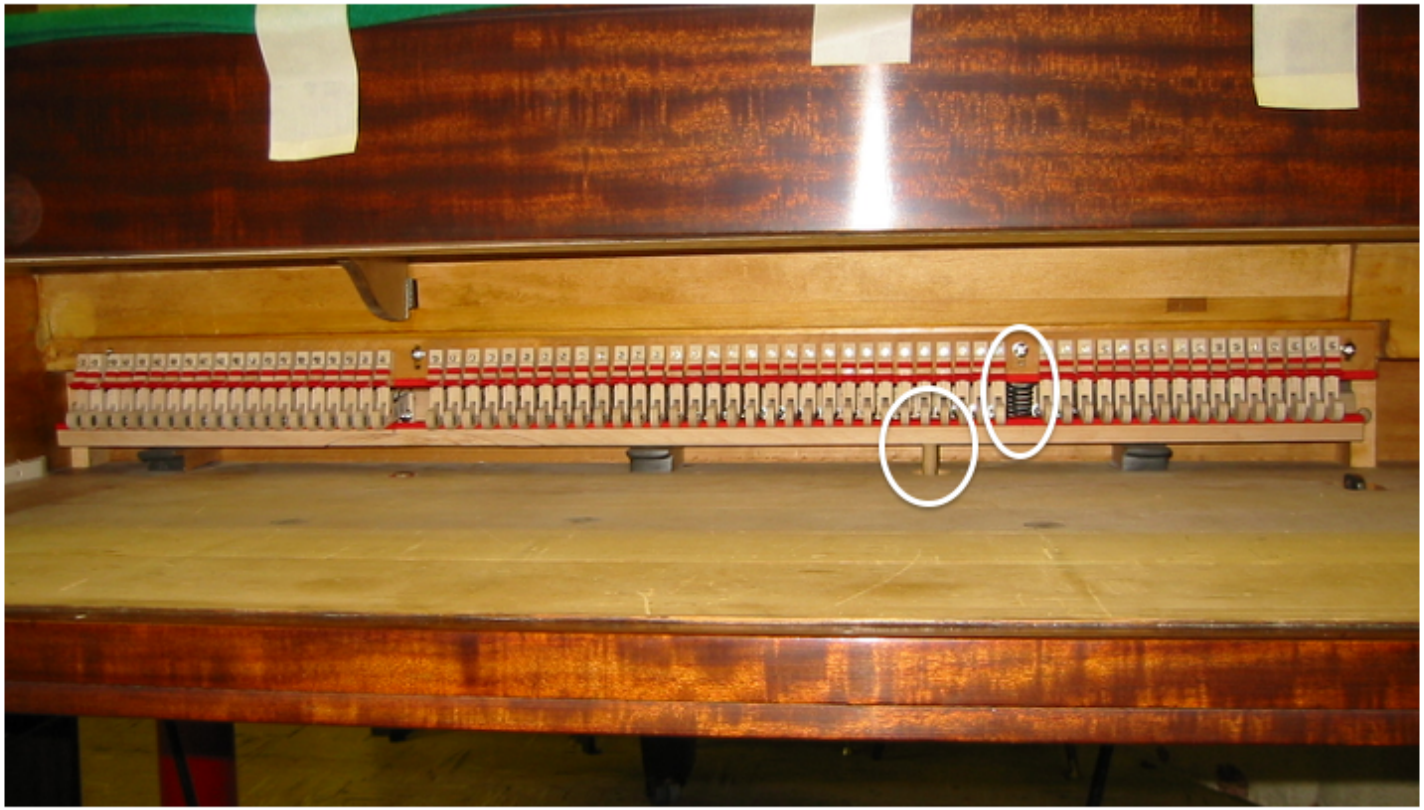
Lubricate the end pins and pivot blocks before installing the tray into the piano for the final time.

Install Stop Rail Before Dampers



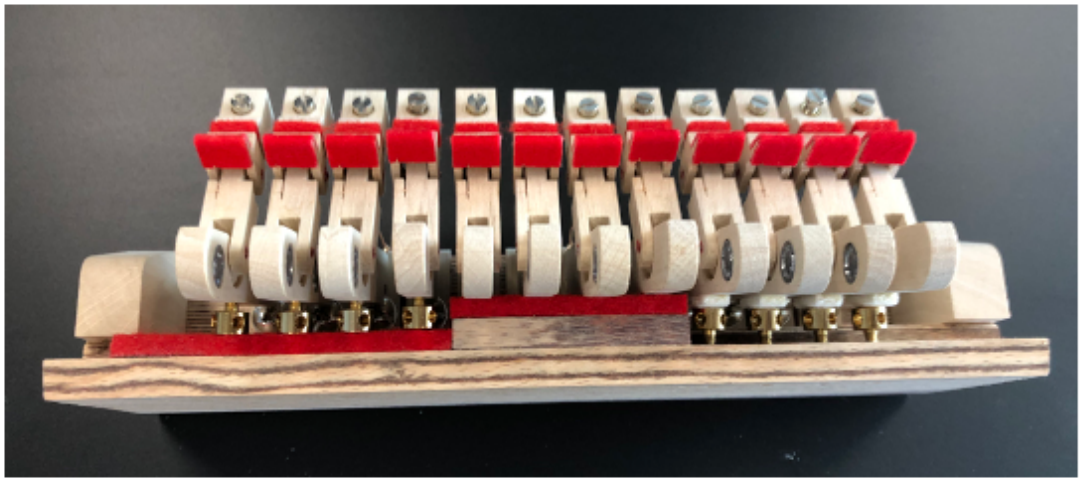
Be sure to install the damper stop rail BEFORE installing the dampers.

Completed Installation



The system installation is now complete, and you can begin re-installing the dampers and regulating them. This picture shows the completed installation in the piano. The modified pitman and relocated return spring are highlighted.

Baldassin "3-in-1" Underlever System



Capstans in the Underlevers | No Capstans | Capstans in the Tray

The ***Baldassin "3-in-1" Underlever System*** by Renner USA maintains the design of the Renner Universal Underlever System, with the flexibility of adding capstans, either in the underlever or the tray, if desired, and can be installed most makes of piano.