

Introduction

Renner provides superior quality bushing cloth in a variety of thicknesses and dimensions suitable for most piano bushing applications, such as action centers, keys, trapwork pivot bushings, dowel hole linings, etc. The high density and uniform quality of these cloths provide the long wear and stability necessary for precise control of moving piano parts.

The beauty of wool bushing cloth is that it can be formed into bushings of any required size and fit, using only glue and a few simple tools. The purpose of this manual is to outline procedures for rebushing some common parts that will give consistent, predictable results. Action centers, pedal and trapwork pivots, and damper guide rails will be covered here as examples of three distinct types of bushings. The principles presented can be applied to other parts as needed. Key rebushing is covered separately in the manual, "Using the Renner Key Bushing Cloth".

I: Rebushing Action Centers

Action centers are an example of bushings requiring low to moderate friction and high firmness. In other words, action center bushings must have friction levels consistent with proper action touch, but must be firm enough to maintain parts alignments even during the hardest playing. Stability with varying humidity levels is also important. Quality bushing cloth and correct procedures are the keys to achieving these results.

Renner supplies special pre-glued and graphited flange bushing cloth strips that are exceptionally easy to use. These strips have pre-formed "shoelace" ends for easy insertion into the flange holes. A water activated glue coating on the outside surface eliminates the need to apply any other adhesive, and the light graphite application on the inside surface provides quiet, trouble free operation.

Tools Required

Renner flange bushing cloth strips
micrometer
centerpin installer/extractor punch
flush cutters
centerpin assortment
pin vise with #39 drill
smooth tapered burnisher
Renner bushing reamers #1859 or equivalent
Renner bushing cloth sizing tool #1855
damp sponge

Procedure

The objective of action center rebushing is to create a center with the correct friction level while still being very firm (free from wobble). This result requires a very dense bushing cloth that is sized to the centerpin using compaction more than reaming.

1. Unpin the old part(s), measure and note the original pin size.
2. Using your centerpin punch, push the old bushings out with one or two pokes around the perimeter. Pushing the bushings out is preferable to drilling since a drill can just as likely cut to one side of the felt and remove wood, leaving an oval hole.
3. Clean out the bushing holes using the proper sized drill in a pin vise. For most parts, this will be a #39 drill (.0995"). You want to remove only cloth and glue residue, and not damage the wood. Best results are had by first turning the drill counter clockwise until it is through both flange ears, then forward a turn or two. This maintains the original alignment of the two holes.
4. Calibrate the bushing cloth: Using a test piece of Renner flange bushing cloth, pull it through the largest hole of the sizing tool. This helps to form the glue stiffened cloth into a circular shape. Next, pull the cloth through one of the action parts to test the fit. The cloth should pull through the holes with no danger of part breakage or cloth tearing. If too tight, pull the cloth through the middle or smallest hole in the sizing tool as needed to allow easy assembly. Size additional strips as needed in the same way.
5. Activate the glue coating by wiping the outer surface of the cloth with a wet sponge. Then insert the cloth through the action part and pull through almost to the end of the cloth. Orient the seam of the cloth according to the Renner specification [Diagram 1 on last page of this manual]. If you are rebushing a number of parts, string them tight together on the same piece of cloth.
6. As each cloth strip is strung with action parts, immediately cut between each part to separate them, but do not cut the cloth between the flange forks at this time. Insert a smooth tapered burnisher slightly into each bushing to expand the cloth, then insert the size centerpin into each new bushing that will be used in the final assembly. This will be the smallest size pin that fits



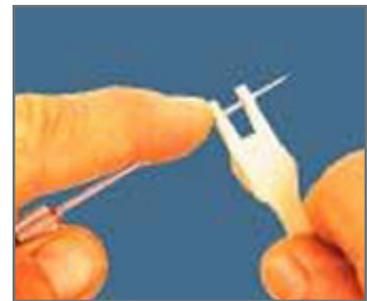
tightly in the birdseye (non-bushed part of the action center), typically one half size larger than the original. This pin, together with the moisture previously applied to activate the glue, will now help to size the bushing to the centerpin, leaving it compacted and stable after drying. Set parts aside to dry in a warm place for several hours. (If doing a spot field repair, 20 minutes drying near a lamp or sunny window sill will suffice. Proceed with more strips as necessary, cutting apart and inserting pins as each strip is completed.

7. After the drying period, remove the centerpins and trim the remaining cloth from between the forks using a very sharp knife or razor. Be sure to trim completely flush with the wood to ensure adequate clearance between the birdseye and forks.
8. Test the fit of the pin in the bushing. Usually it will feel quite tight. Avoid reaming if possible; you will get a denser, more solid bushing if you compress the cloth with a smooth tapered burnisher since coarse reamers tend to loosen up the cloth. Rotating the burnisher slightly, slip it into one side of the bushed part. Note the distance with your finger on the burnisher, then insert into the other side the same distance.

Test the fit of the pin again, checking each bushing separately for equal friction. If compacting with a burnisher will not suffice, reaming can be done using a knurled centerpin or the Renner #1859 special bushing reamers. Always compact with the smooth burnisher after any reaming, before checking the pin fit. Experiment by pinning a few parts together, exercising them, and observing the final friction level. This will help you to develop a feel for the correct pin fit, and speed the work when doing a whole set of parts.

NOTE: The friction level of a freshly pinned part will drop immediately after the first vigorous movement, then stabilize at that level. Therefore it is essential to aim for a fit that feels somewhat too tight initially. After pinning the parts (i.e. shank and flange) together, immediately "exercise" the bushing by holding the flange firmly between the fingers and swinging the shank vigorously back and forth 20-30 times. This will drop the friction level by nearly half, where it should maintain even after further movement.

Bushing friction can be checked using a gram gauge, or in the case of hammer shanks with hammers attached, by the swing test. Four to six swings of the hammer is typical. Gram gauge readings for a few common flange types are listed on the next page.



Action Part	Resistance	Measuring Point
Grand-Hammer shank flange	2 - 5 grams	23mm from center pin
Grand-Wippen flange	2 - 3 grams	23mm from center pin
Grand-Jack	2 - 3 grams	on graphited area of the small arm
Grand-Repetition lever flange	6 - 8 grams	where the drop screw touches
Damper underlever flange	1 - 3 grams	20mm from center pin
Damper body	Should fall from its own weight	

- Before cutting off the pin, always check for wobble. It is possible for a part to pass the friction test but still wobble if one bushing is loose and the other side is tight. Hold the flange down firmly to a solid surface and test by flexing the part side to side. Feel and watch for movement of the centerpin in the bushing.
- Cut the protruding pin flush with the wood.



II Pedal & Trapwork Bushings

Metal trapwork and pedal pivot pins riding in cloth bushed holes are examples of moderately high friction, high load bushings. These parts must support repeated, very high forces without becoming wobbly. Return springs are generally strong as well, so fairly high friction is not a problem but rather a consequence of a firm bushing assembly. Renner offers bulk bushing cloth in four thicknesses and various sizes that will accommodate most such applications.

Tools Required:

- soaking solution (water w/wallpaper remover)
- drill set (64ths or number drills)
- aliphatic resin wood glue for field repair or hot hide glue for shop work
- sharp knife or razor
- rubbing alcohol
- bulk bushing cloth in a variety of thickness

Procedure:

Trapwork bushings need to be even denser than action center bushings to carry the high loads. To achieve this density the cloth must be thick enough to fit very tightly in a dry state. After it is glued into place, it can be sized to the pin using an alcohol solution.

- Remove the old bushings. Usually they are glued in place with a water soluble glue and can be released by wetting with water/wallpaper remover solution. Poke them out with a tool, then clean the holes with a drill.

2. Select cloth thickness and width by trial and error. Bushing cloth will tear into strips of uniform width. First, make a small (1/2") cut near one edge of your cloth and tear a strip along that edge. This establishes an edge that is parallel to the weave of the cloth throughout the piece. Next, measure three times the diameter of the hole to be bushed, and make a starter cut that distance from your original cut. Tear that strip off, then cut a point on the opposite end. Test the strip to see whether it can be pulled into the hole. If the edges do not butt tightly together, the strip is too narrow. If they lap over each other, the strip is too wide.

Once the correct width is determined, insert a piece into the hole, pull half of the strip through, and test the fit of the pin. It should be too tight to allow insertion by hand, but not so tight that the wood part is in danger of splitting. Select cloth thickness as needed. Once correct width and thickness are determined, use the end of the strip with the 1/2" cuts as a gauge for making starter cuts for any additional strips needed.



3. Bush the holes, applying a light coating of glue to the end of the cloth before pulling it into the hole. Trim the cloth leaving 1/4" protruding on one side of each bushed part.



4. Before the glue has set, wet the bushings with rubbing alcohol and insert the pin, or drill or other rod of equal diameter. Push the pin in from the side that has the protruding cloth; this prevents the pin from forcing the bushing out of the hole. Put in a warm place to dry thoroughly.
5. When dry, trim and check the fit of the bushings, They should be quite firm but easily assembled by hand.
6. Apply a small amount of lubricant such as VJ Lube or dry Teflon powder to the bushings, and assemble the parts.

III. Damper Guide Rail Bushings

These are an example of a very low friction, free fitting bushing. They must have negligible friction and a small amount of clearance to the wires to ensure free motion.

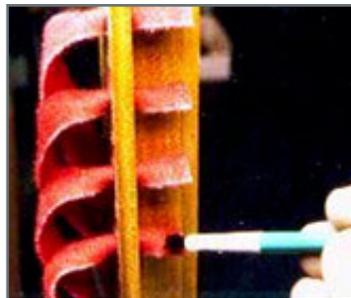
Tools Required:

Bulk bushing cloth in a variety of thicknesses
 number drill set
 #7 bridge pins
 rubbing alcohol
 hot hide glue
 sharp knife or razor
 pointed awl

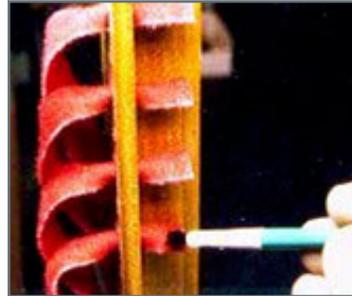
Procedure:

1. Remove old bushings. Most original bushings are not glued or are only lightly glued in place, and can be pushed out with a pin punch or other tool. As with action center bushings, avoid drilling the bushings out as this may enlarge or oval the holes in the wood.
2. Use a drill to clean out any remaining glue or cloth residue. Also use a countersink bit to clean the chamfers on the bottom of each hole.
3. Prepare several strips of bushing cloth of the correct thickness and width as described for pedal and trapwork bushings. Make sure the edges of the cloth butt tightly together when pulled into the hole. A damper wire should slide easily into a test bushing, but not fall through of its own weight.
4. Clamp the rail vertically in a vise so both hands are free to work efficiently. Pull each bushing cloth strip into a hole from the bottom side, skipping every other hole to allow more working room. Align the joints of the cloth downward, toward the vise.

Bushings can be either glued or not. Gluing helps prevent bushings being pushed out accidentally during any future service. However, glue must be applied sparingly to avoid areas that might contact the wires and create noise. Apply a thin surface coating of glue to the last 1/4" of cloth before pulling it flush with the bottom of the rail.



5. When each cloth strip is inserted, seat them against the wood with an awl, working from the bottom side of the rail. Trim flush with the top of the rail. Complete the remaining holes the same way. Note that by working with several strips of cloth at once you minimize wasted motions in tool handling and speed up the work.



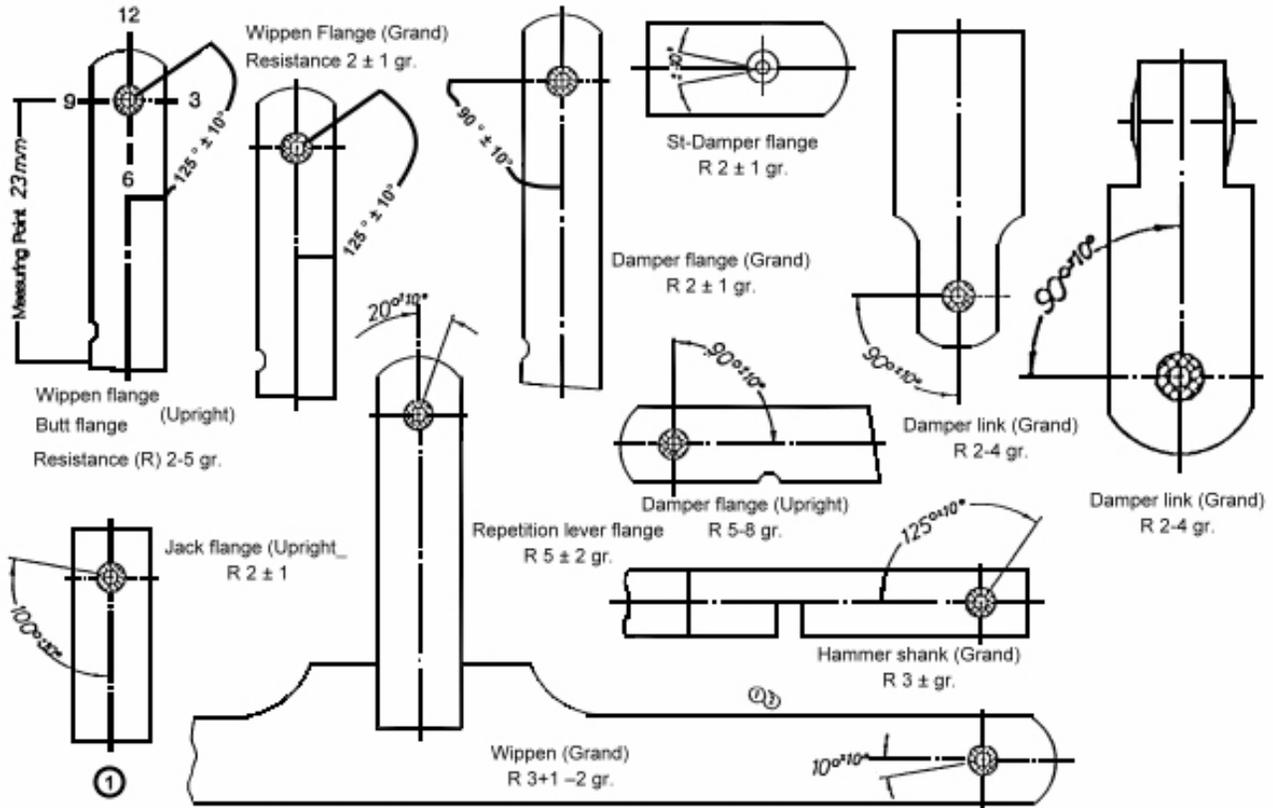
6. Size the bushings by wetting with alcohol and inserting a #7 bridge pin into each. Most damper wires measure .073", and #7 (.086") bridge pins size the bushings to a comfortably free fit. If you prefer a tighter fit, use #6 (.076") bridge pins. Place in a warm spot to dry for several hours. When the bushings are thoroughly dry, they will have uniform, firm holes free of fuzz that will control the damper wires with negligible friction.



Other Applications

The many bushings in a piano can be expertly replaced using quality bushing cloth and the simple techniques described here. Always look at the density and friction requirements of a particular bushing, then fit the cloth and size the bushing accordingly. The easiest method of sizing bushings is by pressing the freshly glued or alcohol saturated cloth while it dries in place, molding it into the desired dimension. This also produces the firmest, longest wearing and most stable bushings, whereas fitting by reaming alone softens the cloth and results in wobbly parts.

Diagram 1



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