Introduction to the Treble Resonator
Designed by Robert Grijalva

Piano technicians who have extensive experience in voicing grand pianos, especially high-end performance pianos, know that in the search for "more power" we sometimes hit a wall. The pursuit of power and consistent timbre is a familiar one, and no area of the piano presents a more challenging task than the region around notes 64 to 74 surrounding the capo d'astro break on most nine-and seven-foot concert instruments.

My personal pursuit of tone and power led me to consider the usual suspects: bad set of hammers, not enough lacquer, poor downbearing, crown, etc. But in some pianos where these clearly were not the offending factors, I had to conclude that the source of my frustrations was another factor that had to be considered: that of belly rail stiffness. This eventually led me to design the Treble Resonator, which is manufactured and distributed by Pianotek Supply Company. I decided that an after-market device was needed to address this problem, so I set about trying to design one that could be easily installed, and yet removed if desired. Moreover, I wanted to come up with a solution that doesn't insult the integrity of the piano's original design. In this, I think I succeeded.

Manufacturers have considered rim and belly stiffness before, of course, and some rather ingenious solutions that we now take for granted are present in pianos we all know. Mason & Hamlin incorporates the famous Tension Tone Resonator that distributes torsional forces in the rim and belly more evenly. Falcone designed a device that stiffened support for the belly rail by incorporating a jack that minutely expanded the rim and belly apart to produce the necessary stiffness. The jack was calibrated at the factory during the voicing process, and locked in place thereafter.

At the turn of the 20th century, prior to the adoption of the treble "bell", Steinway D nine-foot grands had a hefty wooden beam in this location. The adoption of the bell meant the eradication of problems associated with the iron plate lifting in the capo area. Unfortunately, this meant the substitution of a less hefty wooden crosspiece in place of the outsized beam for lack of space. Most of the time this didn't present a tonal problem, but sometimes it did. I was originally looking for a solution to the voicing challenges I was experiencing with tired older vintage Steinway D's and B's here at the University of Michigan School of Music. However, I've found that it can also be beneficial for other makes (such as the Yamaha S6) that have the treble bell design. This was the clue that led me to consider more carefully the significance of belly rail stiffness in producing a strong tone and consistent timbre.

I was inspired to look at many makes of pianos that exhibited strength in this area. Invariably, those that spoke best to my ear had support in the form of a wooden beam or a solid casting that connected rim to belly rail. The obvious conclusion that could be drawn from these pianos was that the makers were concerned with the question of belly rail stiffness, as well as with symmetry of support along the entire length of the belly rail. Pianos employing a radial beam design generally have the beams connect to a cast iron fitting at the break between the wound bass strings and the plain tenor strings. This effectively stiffens the lower third of the belly rail, possibly leaving the rest of the rail less supported and potentially lacking the same stiffness. As with everything associated with the piano, however, this is something that requires evaluation on a case-by-case basis, no pun intended!

The challenge in designing the Treble Resonator was enabling a connection between the rim and belly rail that did not interfere with the vertical bolt that extends upwards to the plate from the treble bell. As mentioned earlier, this vertical bolt is the very reason why pianos of this type do not have a wooden beam at that juncture, leaving a lengthy section of the belly rail unsupported.

I also wanted the adjustment to be mechanically intuitive. The Treble Resonator works by pulling rim and belly toward each other through contraction of the turnbuckle, rather than expansion, as in the Falcone jack design. One should rotate the turnbuckle in a clockwise manner in relation to the plate that is attached to the belly rail. This contraction works to reinforce and integrate the entire system, possibly providing linkage between the belly and the rim, enabling them to expand and contract in tandem through seasonal changes, rather than going their own separate ways.

I must give credit to fellow technicians Patrick DeBeliso, Dan Harteau, and Bob Marinelli, who urged me on in my design attempts. Special thanks also to Roger Arnett, Sound Engineer here at the University of Michigan School of Music, who advised me in significant ways about prototype development.

For my first prototype, I fashioned several three-dimensional models to refine the design, then made an actual wooden replica of the contours of the inside rim of the piano, necessary to provide a true-to-life mold for the prototype. The result was a plate steel weldment with a turnbuckle that, when attached to the rim and belly on a horizontal axis, provided complimentary and positive reinforcement to that area of the belly rail directly beneath the break between capo sections and immediately adjacent to the vertical bolt in the treble bell. Testing was performed on two nine-foot concert instruments at the University of Michigan School of Music. The smaller seven-foot version was also tested on School of Music pianos.

Pianists who tried the first prototype piano were agreed that the tonal improvement was significant. Visiting artists were also surprised at the smooth response across the capo break of the pianos in our Recital Hall. Since these initial successes, the Treble Resonator has been installed onto pianos owned by the Detroit Symphony, Grand Rapids Symphony, and many private clients' pianos.

Successes aside, however, the preceding does not mean to suggest that all radial beam and treble bell-equipped pianos need this kind of reinforcement. It goes without saying that there are multitudes of pianos with radial beam/treble bell design that have perfectly fine tone, timbre, and power throughout the range. I was seeking a solution for older pianos in the University's inventory that exhibited a specific problem that required individual assessment.

Does the addition of the treble resonator represent a "redesign" of a piano in which it is installed? My answer to that is a firm "no". It is no more of an alteration to a piano's design than adding a screw or dowel where deemed necessary by a rebuilder installing a new pinblock or repairing a joint. It's simply addressing a perceived weakness in a specific area of the piano with a piece of added hardware. If needed, it can be removed at any time, and the piano is back to "normal".

Installation of the Grijalva Treble Resonator

GENERAL INSTALLATION PROCEDURE

Before installing a Treble Resonator, consult with Pianotek for advice on the applicability of the device to your piano's situation. Do not attach the Treble Resonator to an instrument that has not yet been fully voiced and whose need has not been fully established. This is a significant installation that, while reversible, requires careful consideration. It requires a well-trained ear and substantial expertise in the arena of concert-level voicing. It is not a "quick fix" or "silver bullet" for voicing the treble of any piano. Significant follow-up voicing is required, as it merely provides a new platform upon which to build your voicing to a new level.

The Treble Resonator consists of three major pieces: the Weldment that attaches to the S-Curve, the Turnbuckle, and the Belly Plate. Align the entire assembly directly below the last duplex rib of the first capo d'astro section. (This is the string rest cast into the plate between the capo d'astro bar and the tuning pins.) This is usually circa notes 66 to 70 on most models of 7-foot or 9-foot grands. Placement should be as close as possible to the vertical bolt that connects the treble bell to the plate. See photos 1 and 2.

Photo 1 General Placement

Photo 2 Proximity to Treble Bell and vertical bolt

Since the piano's rim material is usually hard rock maple or beech, (or a combination of hardwoods, including mahogany), and the belly may be either birch or pine (depending upon the model of piano), remember to use the appropriately-sized pilot holes for the supplied lag screws based on the type of wood into which you're drilling. A right angle drill facilitates the drilling procedure in the tight to reach places.

When drilling the holes into the piano's rim, it is sometimes helpful to use a square to assist in aligning your drill bit. After establishing the position of the Treble Resonator, mark the location of just the first hole for the Weldment end at the S-curve with a center punch or brad point bit. Then, disassemble the Treble Resonator to facilitate the installation. Once the first hole is drilled, attach the Weldment end to the rim with the first lag screw. Subsequent holes may be drilled with the Weldment in place. See photos 3 and 4.

Photo 3 Aligning the drill with the use of a machinist square

Photo 4 Weldment situated in the S-Curve for ease of drilling

For drilling in the tightest spots, use a right angle drill. Use whatever variety of lengths of drill bits that enable you to get the job done neatly, and remember to put some masking tape on the bit to use as a depth indicator. The drill pictured here is a Makita right angle drill. It has a very small profile and can get into tight spaces well. See photo 5 and 6 for examples.

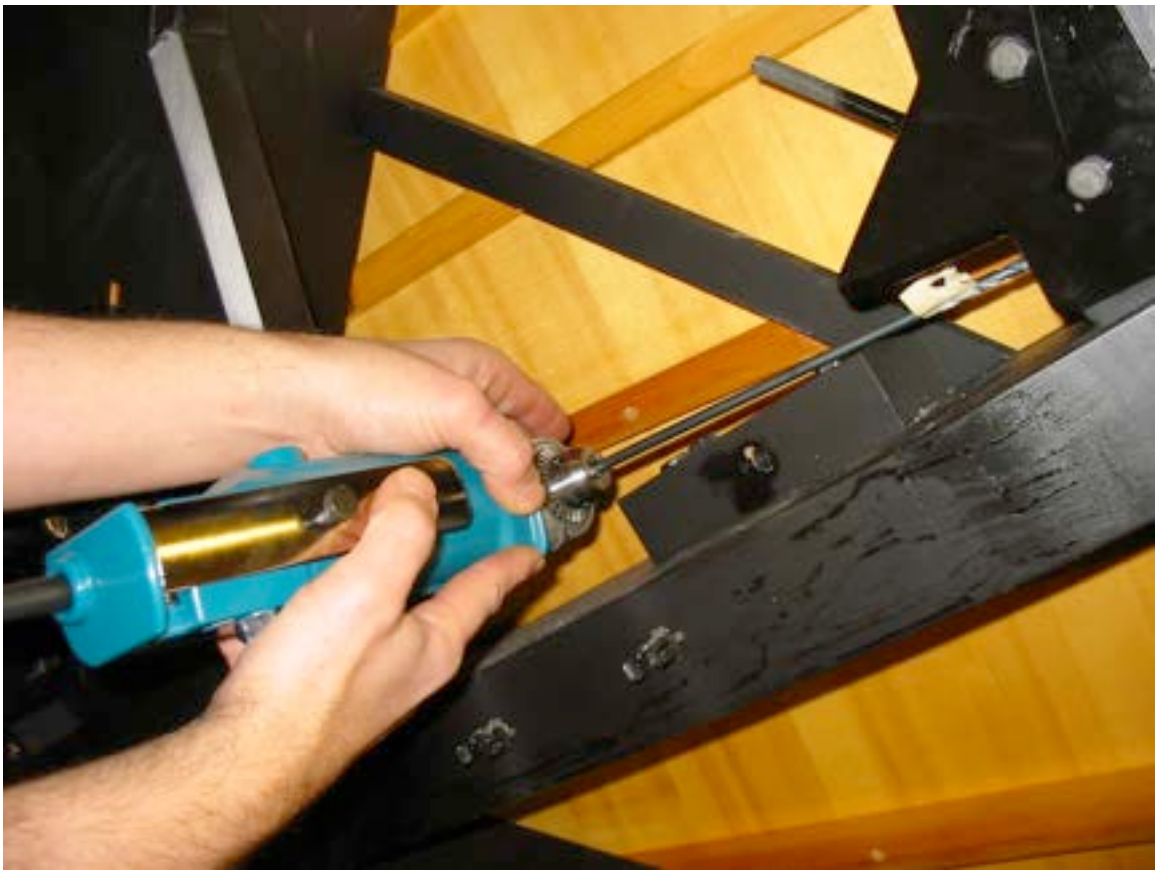

Photo 5 Utilizing an extended length drill bit for the tight spots

Before drilling the Belly Plate holes, remove the Weldment from the S-curve and reassemble the Treble Resonator. Then, extend the turnbuckle and align it as perpendicular to the belly rail as possible, so that the Belly Plate is flat on the belly rail. (The Weldment has a reinforced bolt with an extended shoulder that can be bent to achieve better alignment. Only a minor adjustment should ever be necessary.) Mark the first hole in the belly rail, drill, and install the first lag screw before drilling the two remaining holes for the Belly Plate lag screws. Photo 6 illustrates the use of a shorter bit with the right angle drill. Note the wedge between the bell and the turnbuckle that has been inserted to better align the turnbuckle perpendicular to the belly rail.

Photo 6 Drilling the first hole in the belly rail for the Belly Plate

Photos 7 and 8 show the finished installation…

Photo 7 Final installation of the Belly Plate lag screws

Photo 8. Completed installation of the Treble Resonator

TONE ADJUSTMENT PROCEDURE

For adjustments, remember to rotate the turnbuckle *clockwise* in relation to the Belly Plate in order to *contract* it. Begin with the turnbuckle in the neutral position. It helps to mark the turnbuckle with white-out or paint to show your starting point. In photo 8, you can see the white mark on the turnbuckle and bolt at the Weldment end. Tighten in small increments ($1/16^{th}$ or $1/8^{th}$ of a turn) until the turnbuckle is just snug, then test the tone for changes. Continue tightening in small increments only until you arrive at the best tonal improvement. Judicious tightening is a must in order to avoid the risk of overtightening and damaging the belly rail. Remember that the goal is simply to *stiffen* the belly rail, and not to distort it.

Total rotation usually doesn't exceed 1/8 to 1/4 of a turn for best improvement. There is a point of diminishing returns where additional rotation provides no significant benefit. Discreet listening skills are required to make this determination. Compare the timbre and tone from duplex rib to duplex rib in the first capo section and also across the capo break. Usually the last duplex rib of the first capo d'astro section and the first duplex rib of the second capo d'astro show the greatest changes (circa notes 62 to 75). Once the correct stiffness is established through aural testing, set the lock nut.

Results from the installation of the Treble Resonator are typically immediate. In some cases, improvements continue to develop for a period of 24 to 36 hours after installation. However, there is usually no "settling" period, nor need to readjust later. Field tests have shown no significant tonal losses over a test period of five years in high-demand concert performance venues. Once installed and adjusted, there are no maintenance requirements.