Truss Rod Repair: Extensive Care Unit

By Pat DiBurro

They can't all be easy, right? Several years ago my typical work day was a steady drone of refrets, loose bridges, top cracks, new nuts, saddles, etc. I was bored, and decided to up the ante by specializing in the repair of guitars that required extensive work. It seemed plausible that if an individual instrument warranted 5 to 20 hours of work then I wouldn't need as many of them in the shop to stay busy. Be careful for what you wish. I'll wait patiently for someone to invent the 80 hour week, and hope I can keep up with deadlines until then. This article was intended to explain some techniques I used to correct an instrument with severe neck bow; but occasionally I'll hijack the text and deviate on a whim

Christmas was a few days away and so was winter break, a brief shop shutdown over the holidays. My repair shop is located in the downtown historic district of Exeter, NH on the banks of the Squamscott River which snakes its way to the Atlantic Ocean about 10 minutes east. New England winters are notorious for drying out guitars, and the three months beginning January first are the busiest of the entire year, with several guitars arriving here daily. They're dry to the bone with sunken tops; protruding fret edges that rival the Ginzu knife, and cracked everything. I try to keep conservative with my time estimates on major projects that come in during the winter crunch. I took a call from a gentleman regarding an instrument in his possession that he felt was in need of some work. He had made attempts to locate a repair person and was directed to me though a colleague of mine. With the holiday break coming and a bunch of instruments still not ready for their Christmas caroling duties, I offered to meet with him the next day. He informed me his instrument was a Greven.


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An internet search on the guitars of John Greven that night was my brief tutelage into what might show up on my bench the following day. He has been in the trade of lutherie for several decades and currently maintains a shop in Portland Oregon. There was sparse information available on his construction techniques. I was definitely not an authority on the instruments of John Greven when the owner arrived with his. He opened the Nondescript case and pulled out the most ornate, relief carved, mother of pearl inlaid instrument that has appeared on my bench to date. **Photo 1**. Oh yeah, It had issues as well.

Evaluation: Before I began an evaluation of it's playability I needed a few minutes to soak in the detail of ornamentation that seemed to envelop every angle. Within the boundaries of the ivoroid trimmed fingerboard were finely cut and engraved pearl inlay pieces depicting pixies and other magical imagery. A nude figure dominated the peghead with the maker's name set above it, and engraved pearl machine buttons peeking out the edges of the headplate. The neck was built from two fiddleback lengths of maple sandwiching a sliver of mahogany. The heel was relief carved in a floral design, with an ivory moon faced caricature set into the center. Wow!! The body was a bit toned down. Abalone trimmed edging similar to the C.F. Martin Style 45, with just an extra zing of leaf inlays. **Photo 2**


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As my eyes wandered over the artistry of this instrument I kept getting glimpses of a disturbing bow along the neck's length, and it wasn't subtle. Lining up to sight the straightness of the neck, I saw a forward bow that rivaled some of the wartime


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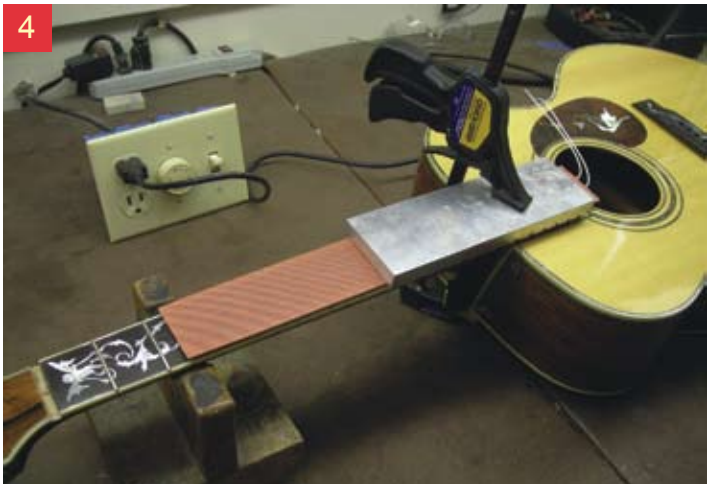
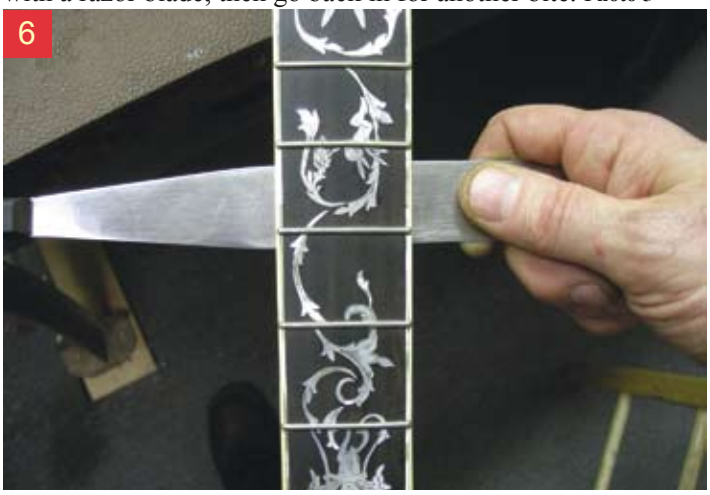
Martins I've encountered with ebony truss rods. This was bad, and there was no visible means of neck adjustment. I put my inspection mirror into the soundhole and looked in vain for some mechanism, perhaps hidden under the shoulder brace, that would bail me out of this one. Nothing there. A .030" feeler gauge slid snuggly between the top of the 7th fret and a straight edge resting on the frets. I reconfirmed this measurement with a dial gauge. **Photo 3**. With the stings relaxed it still had .012" measured at the same location. I've encountered only a handful of instruments with this much bow. The neck angle was low but certainly the least of my immediate concerns. "What did the builder use for neck reinforcement?" I thought to myself. This was built before carbon fiber became a common reinforcement material. Perhaps the square hollow tube C.F. Martin used from the late 60's until the mid 80's? Those necks can get a little soft sometimes pulling into a pretty good forward bow under tension. It wasn't likely the "T" bar also used by the C.F. Martin Company when they discontinued bar frets in the early thirties, they're quite stiff. I pressed a neodymium magnet along the back edge of the neck hoping for a little resistance as I pulled it away. Nothing! So there's no ferrous metal in the neck and probably no metal at all I guessed. I informed the owner that whatever was in that neck wasn't getting the job done and I could install an adjustable rod in its place. Then he threw me a curve ball. He was happy to hear of my acceptance to take on the project, with one consideration. He requested that I install a non-adjustable rod so that the existing appearance of instrument would remain. "Would you like it to shoot flames out of the headstock while I'm at it?" Just kidding, I understood his request to keep the instrument's appearance intact.

Deadlines: Every instrument that arrives in my shop should leave completed somewhere close to the time I told the owner it would. This gets pretty tricky when the work involves major disassembly of the neck or body and, gasp, finish work. Finish is an area that we as repair people cannot completely in control. In fact, I believe it controls me. I prefer the term coating because finish implies that it's done, and after it's applied on an instrument the work is rarely finished. Even the most laid-back customer wants to know when to expect their instrument back. It's not an unreasonable question and I've developed a few replies that have been shop tested with many of my customers and you're welcome to use them at you own peril. Here's one that's kind of open ended and I'll usually follow-up with an actual date. It has a new-age vibe I think, or maybe it's just wacky. "I don't tell the guitar when it's completed, the guitar tells me when it's done." Another response to the "completion" question is to use a season of the year. It's pretty opened ended, depending on which season I choose, but essentially it's a three month block that I can usually work with and complete on time. After discussions of estimated cost and repair methods with the Greven owner he hit me with the inevitable "how long?" Easy DiBurro, don't get cocky on this one, I thought to myself, and replied back to the owner "Before ice out". For the readers fortunate enough to live in warmer climates I'll explain. By January the local lakes, ponds and many rivers freeze with several inches and quite often feet of ice. As winter creeps into early spring the ice melts and at some point the rivers are deemed navigable by water craft, or "ice out". So essentially, I committed to completion of this instrument in early spring, provided we had the usual long cold winter.

I reopened the repair shop after a two week holiday break and was eager to start on the Greven. I'd shoveled the snow from the sidewalk many times that winter and ice was just starting to build on the Squamscott River. First step on the Greven project would be to heat and pry off the fingerboard. I wanted to know what was under that ebony so I could formulate a plan. If a fingerboard needs to be removed with the intent of reinstalling it again then realignment is critical. Fortunately it's pretty easy to relocate the original position. I pulled the 1st and 12th frets out and drilled a 1/16" hole through the fret slot into the maple neck about, a 1/8"depth. The holes are diagonal with one under the 2nd string and the other under the 5th. Just prior to the reinstallation of the fingerboard a couple of nylon pins are inserted into the neck. These locating pins assure correct position and the nylon can be sliced with a fret saw prior to refretting. Dyed epoxy is the predominant method for setting pearl inlay. My concerns were applying enough heat to soften the neck/fingerboard joint without overheating the epoxy, which could lift the pearl. Perhaps the builder used hide glue or aliphatic resin, and not epoxy to secure the fingerboard. Will the pearl act as an insulator preventing the heat form traveling down to the glue joint? I wasn't sure but it crossed my mind as I laid a Benchmark silicone heating blanket on the fretboard surface. These blankets can be plugged directly into a 120 volt outlet and will vaporize pearloid inlays in seconds. I was heating the fingerboard extension of an older Gibson flattop years ago with a heating blanket and heard an unusual sound, vvvvvsssssstttttt, coming from the guitar. At the same time a noxious cloud of smoke trailed upward from the fingerboard. Now I pull the celluloid inlays as a precaution. Some luthier supply companies offer a control unit for silicone heating blankets and I wouldn't use a heater without one. I fabricated a controller myself with a timer and rheostat from Home depot. **Photo 4**. The timer has saved many instruments from overheating when the phone rang and I became distracted. I back up the controller time with a



little egg timer. The rheostat is the key to the whole system and it takes time to learn what setting works best. My advice would be to start on a low setting. I set some cauls on top of the blanket so it would maintain good contact with the fingerboard, unplugged the telephone, and waited. Six or seven minutes passed. I removed the heating blanket and pushed my spatula under the fingerboard extension. It sliced the glue joint with a familiar resistance and release. I pulled the spatula out and the steel edge had traces of aliphatic resin. Ok, so far so good. I've always used a long spatula for bridge and fingerboard removal tapered down close to the edge. Each time I slid the thin blade into a glue joint I would pull it out and remove the glue residual with a razor blade, then go back in for another bite. **Photo 5**



After the fingerboard extension was free from the spruce top I turned the blade parallel with the frets, and with one hand on each side of the blade, slowly cut through the joint using a back and forth force towards the nut. If the glue is soft enough the spatula will follow the path of least resistance. **Photo 6**. A cold glue joint might hold back the spatula sending it into some grain run out. Things can get really, ugly really fast. This was a clean removal with no incidents. With the fingerboard off, the problem was quite evident. There was no reinforcement in this neck. I scraped the glue residue off the fingerboard bottom and face of the neck and pulled those out. I clamped the fingerboard unto a flat piece of granite with a radius caul on top to help prevent it from curling or twisting. **Photo 7**. I had a few possible choices for reinforcement material. Carbon fiber rods were an option but I would have needed a channel depth of ½" for enough strength, and my measurement of the neck thickness indicated a safe rout depth of only 3/8".

With the changeover from gut to steel strings, guitars required more rigid reinforcement to maintain neck straightness. In the early 1920s, the Gibson musical instrument company was granted a patent for an adjustable truss rod, and maintained the exclusive rights to an excellent design for decades. Other Manufacturers relied on non-adjustable reinforcement bars of varying shapes. The Chicago Harmony Guitar Company proudly proclaimed "steel reinforced rods" on the headplate of their instruments. My personal experience working with non-adjustable rods is that they're all over the place. Some necks have remained straight with maybe even a bit of back bow, while a different neck with the same construction may deflect .020"- 030". With a few exceptions, such as this Greven, my work is the repair of the instruments manufactured by the Taylor and C.F. Martin companies. Taylor utilizes a truss rod that is similar in design to Gibson's, which works quite well. It was only 25 years ago that The C.F. Martin Company switched to adjustable truss rods. Through the previous 151 years of production they were all non adjustable. I travel to Nazareth, Pennsylvania one week every summer to train in the C.F. Martin repair department. Observing their approaches to the repair of non-adjustable necks has been has been a great help to me, and yes, it can be done. They have developed techniques to straighten necks that involve reverse planing of the fingerboard and the installation of frets with tangs thicker than the slot, to wedge or compress a fretboard. The methods can be involved and I'll detail them here only as they relate to the repair of this Greven instrument.

By February I managed to get the Greven back on the bench to continue the work began in January. This was a particularly cold winter and guitars were arriving daily with serious dryness issues. The Squamscott had frozen over solid and "bob houses" dotted the center channel of the river. Brave, or perhaps crazy fisherman, drag theses hand built structures from the shore and out onto the ice. Inside the shacks they bore holes into the foot thick ice and bob for smelt. It gives them an excuse to get out of the house for a few hours I guess. I decided on the installation of a square 3/8" hollow tube for the reinforcement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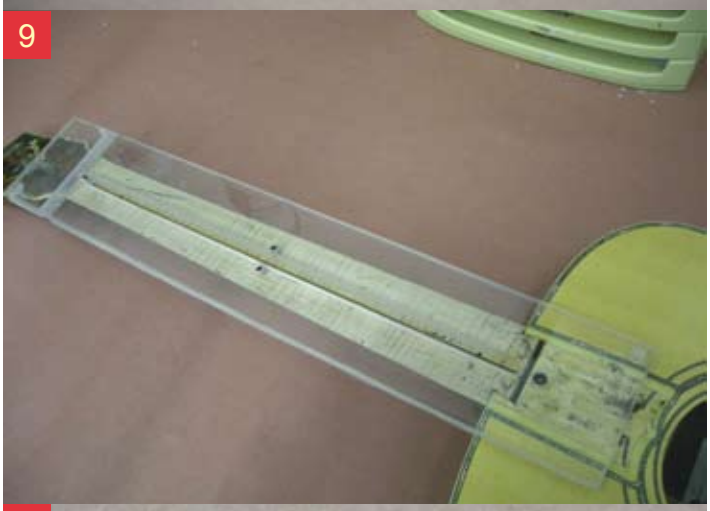
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of the neck. Stewart McDonald, the luthier supply company offers an excellent truss rod that I choose for this project. Essentially it's the same dimensions as the tube used by the C. F. Martin Company and works great as a replacement for rods that have failed. The Stewart McDonald product is constructed of stainless steel and my non-scientific flex test has convinced me that the tubes made of SS are stiffer than the standard steel version. With the method chosen to correct the bow it's time to convert a good part of this neck to sawdust. I constructed a simple jig of ½" Plexiglas to safely rout a channel in the neck. **Photo 8**. The thickness is pretty important because there shouldn't be any flex of the jig that might cause an uneven channel depth. The width of the slot in the jig is just slightly wider than ⅜" to prevent the bearing guides on the router from binding up. The jig is secured to the neck with small countersunk screws into predrilled holes in the maple neck. **Photo 9**. Having the neck still attached to the body made this whole setup more stable and easy to manage. The bit to cut this channel has a ⅜" carbide tipped width , with a cutting length of ½". Four bearing guides of equal widths were slid down the ¼" shaft. **Photo 10**. With the bit chucked into a laminate trimmer I made several passes over the jig, each time lowering the cut depth in ⅛" increments. **Photo 11**. As I started cutting close to final depth, I dropped the tube down into the channel until the top of the tube was flush with the face of the maple. **Photo 12**. At the C.F. Martin factory the workers put a slight bend in the tube prior to installation. It's a kink near the spot on the tube that lines up with the 5th fret


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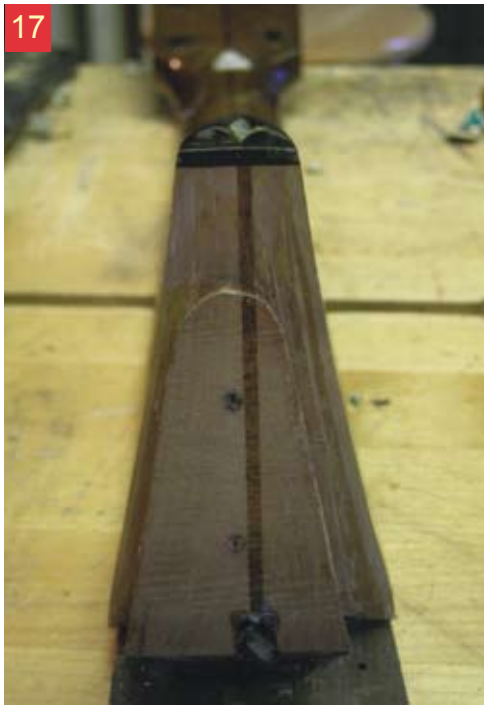
location. The amount varies, depending on the stiffness of the rod. The end of the rod typically ends up about .010" higher. This bend preloads the lower fingerboard into a slight back bend and under tension it will straighten out. With a magic marker I placed a mark on the tube at the spot where it 5th fret would be and slid it into a 1" hole in my workbench. It didn't require much force to sufficiently coax it into a slight angle. Sometimes epoxy's just the right choice for adhesive and for securing a rod permanently into a channel it's my go to glue. I've tried many different brands and for several years I used the West System 2 part Marine epoxy. It's a great product that comes with optional pump dispensers for trouble free pre-measured mixing. The viscosity of the product out of the can is thin, similar to warm honey. **Photo 13**. I often add Silica Thickener to the mixing cup to stiffen the mix and cut down of the flowout. The fibers of this product are very hazardous to the respiratory system so read the label and wear appropriate safety gear when using. With a popsicle stick I laid a bed of the mixture intothe bottom of the channel. As the rod was pushed into the channel



a nice even squeeze out of epoxy oozed. **Photo 14**. This was a good sign I had good even distribution of adhesive along the tube. I removed the excess epoxy from the face of the neck and laid a 1" wide piece of wax paper over the rod. Over the paper a straightedge with a ¾"witdh was secured in place with Quick Clamps.

Photo 15. A day later the clamps are pulled and the remaining residue scraped clean. **Photo 16**. With the bull work completed it was time to steam off the neck so I could correct the neck angle issue. The neck released from the heel block cleanly with just 30 seconds of a steam blast. Nylon pins were placed into the neck to realign the fingerboard prior to clamping. Coming out of the clamps, with the fingerboard and binding back in place I scuffed the finish along the binding edges with 220 grit paper, taped off the fingerboard and shot four coats of lacquer with a pre and post coat of 100% thinner to soften up the existing finish. A few weeks later the new finish was cured enough for sanding and buffing. Wasting no time with a

deadline approaching the neck angle was cut, dovetail fitted and pressed back in place. There was a curious offset to the neck dovetail and heel block. **Photos 17 & 18**. I'm not sure what happened here but everything lined up nicely with even lines on either side of the heel and fingerboard extension so I didn't sweat it. I was anxious the next day to pull the clamps off the neck and measure the neck under tension. The neck was still fretless as I strung it up with a set of light gauge strings. The neck relief gauge just prior to stringing measured a very comforting .004" of back bow and now with the Greven tuned to pitch the neck pulled forward to .009" for a total movement of .013". The owner in addition to his request of a nonadjustable rod had one more item on his wish list, .004" of relief plus or minus a .001". The cold winter showed no signs of letting up with single digit temps. as I turned the calendar on March. I had a full shop of dried out guitars so I put the Greven on a shelf still under tension for a few weeks. We had a warm up in mid-March and I started getting nervous about the deadline on the Greven. By late march it was once again back on the bench and the ice on the pond near my house was fading fast. All that remained was the installation of the frets and they were the key to getting this neck to the desired relief. Out of necessity to straighten their necks, the C.F. Martin Company sells their standard fret crown with 7 different tang thicknesses from .0185 to .0245. By carefully measuring a thickness of a fret slot and selecting a fret of a thicker number the fretboard can be straight or even back bowed. Compression fretting is a common term for this method and it's aptly named. The area of concern is frets 3 through 10. Above and below that area the frets do not have as much affect on the neck curvature. The fret slots on the Greven measured a pretty uniform .021" so I decided to hammer in some big boys, .0245". I tapped in the seven frets in positions 3 though 10, made sure they were well seated and strung it up again. The relief gauge read .005", good enough for me. I went back to frets 1 and 2 using the same .0245" fret then thinned out to .0225 for the remaining frets to make it easier to set them. I've purposely neglected to include completion pictures because it appears now as it did in **photo1** except for the bow. I had to look pretty hard for any sign of remaining ice on the Squamscott River. The"bob houses" had been pulled off the river a few weeks back. I called the owner with the news his guitar was ready to go. One project completed on time while the clock spins fast on two dozen more. □

Pat DiBurro has been an ASIA member since 1993, lives near the NH seacoast with his wife Andrea. When he's not working on guitars, he's reading about working on guitars.

Tom Monaster takes time out to smell the flowers at the ESU campus

From the A.S.I.A. Board President

By David Nichols

What a ride! The ESU symposium in June seemed to transport me to a level beyond my everyday life to a whirlwind of activity and excitement reminiscent of the very first symposiums.

I would like to personally thank all of the people who journeyed to the symposium and both taught or attended the many demonstrations and lectures. It was very clear to me that our goal of sharing information was well met at this symposium. I would hope that everyone was as positively impressed, as I was, at the quality and level of the gathering.

Board Meeting

In attendance were Charles Hoffman, Rolfe Gerhardt, Dick Boak, Dan Erlewine, Bryan Galloup, and myself (David Nichols). Absent was Frank Ford.

Discussion was held regarding the success of the current Executive Director, A. Bear Acker and the positive influence he has had on our organization. In a very short span of time, Bear has been able to not only publish the magazine in a timely and professional manner, but also to work with the Board and members in organizing a very successful symposium. Our finances indicate that we will be on solid footing for the next two years.

Restructuring of the Board

I was elected to become Board President. It is the time that a few of the board positions will be filled with new members. Members of the board who are replaced will be named to an honorary position of Executive Advisory staff. Several people have indicated an interest in becoming a board member, and if you are interested or know of anyone who you would like to recommend for this position, please drop me an email at cpinlay@aol.com.

We are looking for members who will contribute both literary articles for the magazine and have the business experience that will help guide A.S.I.A. The ideal board member(s) will be in a position to contribute their time based on their business success. The outgoing Board members have been there because of their devotion to lutherie and their personal financial stability that allowed them to donate their time and effort to support the organization.

The new Board members will be announced in the next issue of Guitarmaker. Thank you everyone for your support, especially the Board members who will be retiring as they have been with us through thick and thin and have added so much to the organization. □