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DIAGNOSIS OF CLASSICAL GUITARS

and other plucked string instruments

Before we begin, I would like to clarify something important

This is a descriptive guide intended to show you my criteria when performing a technical inspection of an instrument in the workshop, at a conservatory, in an orchestra, or in a client's home.

You will not find magic solutions here, nor "easy fix" practices, which are as invalid as they are popular nowadays.

The objective of this educational resource is to introduce you to the field of professional lutherie, to familiarize you with the terms used, the parts, components, and main characteristics of these instruments. It also serves to inform you of some of the causes and consequences that give rise to the most common problems suffered by Classical Guitars and the broader family of plucked string instruments.

With this introduction complete, I invite you to explore the analysis guidelines.

1. Instrument Category

Broadly speaking, in terms of materials, production processes, and resulting quality controls, musical instruments can be classified into 3 categories:

Disposable (weekend guitars), **Student level** (beginner and intermediate), and **Luthier-made/Concert** (professional level). It is fundamental to know "what type of instrument we are evaluating" to know the limit of improvement we can achieve.

Therefore, the first step is to distinguish if it is built with **solid woods**, **laminates** (plywood), or mixed; what type of **varnish** coats it (French polish/shellac, synthetic lacquer, polyurethane, etc.); if it has painted wooden parts; if it has **bronze** or **nickel** frets; if its **tuners** are antique (made with wood, bronze, silver, steel), if they have fine/thin shafts, if they are metallic with a **vintage 37mm** spacing or if they are contemporary with **standard 35mm** spacing.

2. Stiff Tuners

We know that changes to the instrument's climate (standard conditions of temperature and pressure) alter the dimensions of materials (expansion and contraction), modifying the fit of the shafts and eyelets of the tuners (where the strings couple) in the head of the instrument (the headstock).

In turn, these temperature variations in metals (cold to hot) drive condensation and evaporation of ambient humidity, which dry out a mechanism's lubricants and promote corrosion, impairing its function. They can also jam due to incorrect mounting (e.g., missing anchor screws) and contamination by dust, threads, and lint. Another very common cause is improper string installation (due to anchoring with knots that are too large and extensive), overlapping coils, and too many winds that press against the inner walls of the headstock slots.

3. String Breakage (Cutting)

In principle, one must estimate the normal wear of the strings, which stretch and "thin out" until they collapse.

On the other hand, the friction existing between the strings and the slots of poor-quality nuts (see point 8) generates sharp edges that "peel" the gauge of the strings until they no longer tolerate the nominal tuning tension.

Another cause is a mechanical problem, originated by the lack of or improper polishing of the nut slots. An even more complex technical problem concerns the "angle of the headstock" (i.e., those that feel stiff when playing). In this latter case, it is recommended to try different low tension, medium tension, or mixed tension string sets.

4. String Height (Action)

Other inquiries concern discomfort during play (hands, arms, and neck hurting) and physical injuries (tendinitis) caused by the excessive force or pressure required to generate a clean, projective sound with volume and power. In general, this string height usually increases when the neck "bows" or gives way (due to inadequate wood, poor seasoning, or structural deficiencies).

5. Tuning Issues Derived from the previous problem, those rare "tuning issues" also tend to appear, resulting from the bowing of the neck in conjunction with the fretboard (where the fret scale is established), since these deformations modify "the lengths of the vibrating string distance."

If the alignment of the neck with the body is acceptably adequate, we must review the relationship of distances existing between the bridge position and the fret scale, since very likely, the origin of the sonic failures is caused by a "calculation error" (intonation error).

6. Nut Adjustment

Although neck curvature is also a factor, it can sometimes simply be a "factory defect" due to the use and mounting of pre-molded PVC parts. In general, I always change them (see point 8), but I know people who dare to sand them down, seeking to adjust their heights "so they are a bit more comfortable."

Contrary to popular belief, this task requires great precision to achieve the proper result, as there is a precise limit to "not go too far" and generate another problem known as "fret buzz."

As a reference, one could estimate that the "average string height" at the 12th fret position (the junction of the body and the neck) is around **4.5 mm (+/- 0.5)** on the 6th string (Bass) and **3.5 mm (+/- 0.5)** on the 1st string (Treble).

7. Fret Buzz, Rattles, String Clashing

More than once, I have observed instruments with the headstock, neck, and fretboard all twisted.

One of the causes of this defect is the "traction force" (tension) exerted by the strings when tuned, settling with different cumulative tensions. The successive repetition of a "tuning disorder" (tuning from bottom to top, for example) deforms the necks and twists the angle of the instrument heads. These twists generate differences in height between the strings and the frets, causing strikes and buzzing in certain positions.

Buzzing can also occur due to the deformation of woods used to build the fretboard that are poorly seasoned, reacting with warping and lateral twisting, upwards, downwards, and sometimes in multiple directions, transferring those deformations to the frets in certain positions.

Another factor is normal wear and tear, with frets having different heights, where grooves or channels are observed, in addition to divots (pitting) in the fretboard wood itself.

In summary, we could say that the vast majority of "clashes between strings" (buzzing) usually happen due to the existence of different levels and tension adjustments, which are sometimes caused by manufacturing defects (material flaws) and often by the simple fact of improper use of "old strings mixed with new strings."

8. Weak or Low-Quality Sounds

One of the main factors affecting the volume, clarity, conduction, and projection of sound is the use of prefabricated parts made of synthetic materials and PVC derivatives (resins, plastics, polyurethanes, acrylics, etc.), incorporated into mass production "to lower production times and costs."

These components are usually more porous than bone or hardwoods, "absorbing the vibrations of the strings" rather than transmitting them to the soundbox (resonance chamber), resulting in reduced acoustics and dynamic ranges that our instruments can generate.

Furthermore, they tend to have "casting residues/defects" (from injection molds and dies), which hinder their correct seating and fit in the slots where they are placed.

Finally, we must mention that all instruments containing "plastic" components (the most common being glossy, matte, or semi-matte polyurethane finishes) will suffer acoustic alterations, due to the excessive hardness that these indestructible materials impregnate into the woods, which "retain" (dampen) the vibrations of the parts that comprise them.

Therefore, as a concept, we can define that the fewer plastic components an instrument possesses, the better its sound will be (confirming once again that "plastic contaminates").

9. Bridge Gluing

In all string instruments, it is essential to verify the state of fixation and fit of the bridges (where the strings pass and are anchored).

In older instruments, there are often infiltrations (gaps) between the joints, which allow "the entry of ambient humidity." This, along with temperature variations and the constant tension of the strings, favors the disintegration of collagen (breakdown of the glue), generating "progressive ungluing."

In contemporary instruments, although they use other types of more resistant adhesives (such as vinyl, synthetic, and aliphatic resins), these parts tend to lift because they use "prefabricated bridges" with different measurements that do not correspond to the "glue footprint" (masking area) used in manufacturing, resulting in defective adhesion.

10. Annoying Noises

Instruments travel with their owners; therefore, they are exposed to climatic changes, variable stresses from vibrations, bumps, and jolts during transport, and accidental blows that can damage their structures.

Sometimes we may encounter some unglued assemblies, loose braces, fissures, cracks, and, in the worst cases, broken parts that rub against each other, producing a "buzz" when playing.

Strange noises can also be generated by adhesive residues and shavings trapped in "dust bunnies" that roll and rattle inside the box.

And finally, one must always check the length of the excess string ends, which may be rubbing against the ends where they are knotted (tuners, bridge, and soundboard).

As we can see, there are several "considerations" to take into account when performing a technical survey. While they are detailed here using a logical order to facilitate understanding, it would be convenient to interpret them as "routine checks that should be performed to know the general state of an instrument."

The most important thing to understand is that all of this is relative and that, fortunately, it has a solution.

I hope this material helps you better understand your instruments, sparks curiosity, and encourages you to continue investigating and learning more perspectives on these arts and trades of lutherie.

See you soon!

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