Joshua Williams

CP British Lit and Comp

12 April 2013

How the Martin & Co. DCPA5K Acoustic Guitar is Made

Of all the things in the world of music that go unnoticed, the intricacies of the acoustic guitar tops the charts. There is undeniable beauty in the sounds produced by the guitar, but even more to be found within it. Martin & Co. guitar brand was established in 1833, and has since produced and sold over 50M guitars. The Martin & Co. brand is renowned among guitarists, and recognized all over the world as being number one in the production of quality instruments. A best-seller in today's instrumental market is the Martin DCPA5K acoustic guitar. Modestly priced at $800, Martin & Co. sells hundreds of these guitars every year. An acoustic guitar is composed of many parts. The headstock, tuning pegs, neck, fretboard, strings, body, soundhole, and bridge are the most integral ones. If any of these eight pieces of the puzzle were missing, the guitar would not be a guitar.

Beginning at what some might call the "top" of the guitar is the headstock. The headstock exists purely to anchor the strings to the guitar. The DCPA5K's headstock is medium-sized, and angled backward at eleven degrees, so as to add sound dynamics throughout the fretboard. Red Cedar wood is used for the headstock to neutralize the sound; Red Cedar neither accentuates high or low frequencies, making it ideal for use. Every Martin headstock is soaked in water for twenty-four hours in order to prevent snapping or splintering in the wood.

Mounted onto the headstock are the tuning pegs, which are used to tune the guitar by either tightening or loosening the strings. Every Martin tuning peg is cut and sanded by machine, then engraved by hand. A small hole is drilled through the base of each tuning peg, about 1/16" above where the peg is screwed into the headstock. This hole allows for a string to be threaded through. When a peg is twisted clockwise, the string is wound around the peg, creating increased tension throughout the string, therefore increasing the pitch. If a peg is twisted counterclockwise, the string is loosened from the peg, decreasing the tension throughout the string, and therefore decreasing the pitch. A tuner helps the guitarist to know when the correct pitch for each string has been achieved.

Connected to the base of the headstock lie the neck and fretboard;

two pieces connected to form one entity. The neck of the guitar acts as a runway from the bridge to the headstock. Because the neck itself should not affect the guitar's sound, Martin & Co. uses Red Cedar wood for the building of the neck. The use of Red Cedar is key here. Most guitar-making companies choose not to use woods like Red Cedar because they are neutral woods. The sound of a Martin guitar is so unique because the body, soundhole, and strings are the only parts responsible for the sound. Most Fender acoustic guitars are made with Walnut which produces a bright, piercing sound. Many Gibson guitars are made with Swamp Ash which creates tones so deep they sound muddy. The surface of the neck of the DCPA5K is thinly laminated, then metal inserts are placed into grooves carved out of the neck, acting as barriers between half-step musical intervals. Each half-step is called a fret. Twenty half-steps along the neck make up the fretboard. In standard tuning, the sixth and largest string is tuned to a low E frequency. This low E is located at fret zero, meaning the string is being played "open". If the guitarist presses the string to fret one, the pitch created is now an F. At fret two, F sharp (F#), and so on.

The Martin DCPA5K has a total of six strings, which are anchored to the guitar in two places: the bridge and the headstock. The strings on a guitar are responsible for creating the sound frequencies. Standard Martin

& Co. strings are made of steel wire. The strings are examined under a stereomicroscope and magnified one hundred times to ensure that there are no flaws in the wire grain. After passing this test, the wires are shaved in a circular motion, going "with the grain" of the wire, until the wire's necessary diameter is achieved. Strings under tension vibrate at a rate that produces a frequency, or "pitch". The pitches capable of being produced by a string are determined by the string's diameter. The Martin DCPA5K comes equipped with medium-gauge strings. In standard tuning, from thickest and lowest to thinnest and highest, the strings will be tuned to the following pitches: E A D G B e. The low E string has a diameter of .049". The next smallest string has a diameter of .038 and, in standard tuning, produces an A pitch. The D string's diameter is .028". The fourth string has a diameter of .018" and produces a G pitch in standard tuning. The B string has a diameter of .014", and finally the high e string's diameter is .011", making it the thinnest, highest frequency-producing string on the guitar. When in standard tuning, the high e string produces a pitch exactly one octave, or twelve half-steps higher than the low E string. Though every guitar string can be taken out of standard tuning, and tuned to a different pitch, they all have a specific threshold. For instance, the A string will never be able to be tuned to a high e. Each string can only produce pitches up to one-half step below the next string's lowest possible pitch. The string will snap if the guitarist tries to force it

to be tuned beyond its capabilities. After the core wires of the strings are cut precisely to the right diameter, bronze wrap wire is wrapped by machine around the core wire. Bronze wire is used because it is a light metal and only mildly affects the tone produced by the strings. After the strings are wrapped, they can be anchored to the bridge of the guitar and wound through the tuning pegs.

The strings create the sound, but the body of the guitar is responsible for manipulating them. In fact, the body of a guitar has a larger effect on the sound produced by the guitar than the strings themselves. Sound waves created by the strings enter the body of the guitar through the soundhole. There the sound waves are interrupted by the inner workings of the instrument. In most guitars, three wooden beams are placed within the body to help support the structure. Martin guitars, however, are equipped with four wooden beams, not for support of structure, but for the support of sound. As the sound waves move about inside the body, they bump into the supportive beams, which interrupt the flow of the waves, and therefore force the sound to linger a little longer in the body. This creates the full, thunderous sound that is unique to Martin guitars. The fourth supportive beam also acts as an additional buffer, which prevents the sound waves from agitating the strings a second time when exiting through the soundhole. The most important part of a guitar's

body is the wood it is made of. Much like human skin, all wood has natural pocket-like grooves called pores. Each wood also has a grain, which fills the space between the pores and acts much like a binding for the fibers of the wood. Every Martin DCPA5K acoustic guitar body is made with Basswood. Basswood is a soft, flexible wood with a tight grain and large pores. The pores in the wood of the body create more space for the sound to fill before it can exit through the sounhole. Therefore, wood with larger pores creates a deeper, more hollow sound. The grain of Basswood is tight, which means there is more grain than there are pores. The ratio of grain to pores in Basswood is about 1.5:1. This ratio creates a perfect balance. The deep pores allow for a full sound, while the tight grain creates a crisp clarity in the tones, keeping the sound from getting muddy.

The sound produced by an acoustic guitar would be harsh and metallic if it were not for the soundhole. The soundhole acts as a gateway for the sound waves. The sound waves enter the body of the guitar through the soundhole, where they are then manipulated and finally pushed back out through the same hole. The size of the soundhole plays a huge part in the sound produced by the body. Larger soundholes produce shallower sounds because they allow sound waves to move in and out of the body quickly and without interruption. The Martin DCPA5K bears a small soundhole, which forces the sound waves to linger in the body and

escape slowly, creating a darker, longer-lasting sound.

Finally, a wooden insert is place in a groove carved out of the body of the guitar. This insert is called the bridge. The bridge has six slots carved throughout it, each slow perfectly shaped and sized to house the end of a string. Here the string is pulled tightly and anchored to the body of the guitar. Directly below the bridge are six holes, where the excess string lengths are threaded and plugged into the body with ivory pegs. Exactly like the headstock and neck, the bridge is made of Red Cedar wood. The neutral wood allows the body, strings, and soundhole to create the sound with little to no interruption from the rest of the structure.

There is truly so much more to this instrument than meets the eye. A listener might give credit to the guitar player for the a masterfully-played melody, but a musician understands that the guitar, its maker, and science are truly responsible for its beauty.