

Student Name: Hamish Cranstone

Student Number: 1801893

Programme of Study: BA Automotive Design

Module: ADDA4001

Tutor: Andre Elista

Materials and Construction Methods.

In this essay I will be going over and explaining my findings after disassembling and investigating an object. I will be looking into the materials used and the construction methods used.

I have decided to disassemble my electric guitar. It is a mid-low end guitar so the guitar has many quality parts but it obviously isn't up there with guitars that are custom built so some of the parts are slightly cheaper than more expensive models.

History of the Guitar

The guitar is one of the most popular musical instruments and has a history that can be traced back over 3000 years. It has gone through many different shapes and forms and is still changing with peoples musical influences.

"Modern period of guitar history started with the exploits of Spanish guitarist and luthier Antonio Torres Jurado who in late 19th century managed to create a guitar design that was so superior to any other then in production. This guitar became widely copied after his death, and very quickly became the standard model of acoustic guitar that was played all around the world. His design of "classical guitar" can today be found in all modern acoustic guitars. Another important moment in the history of guitar happened during 1930s with the introduction of electric guitars. Manufacturers like Gibson, Fender and others managed to completely revolutionize the way guitar was used in modern music, off course with the great help of musicians like BB King, Elvis and others that actually used them in their popular rock and roll songs."

- <http://www.guitarhistoryfacts.com/guitar-history/history-of-the-classical-guitar/>

Bill of Materials

Part	Quantity	Material	Assembly/Construction Method
Body	1	Mahogany	Body is made of two pieces of wood that is glued together with an epoxy resin.

Neck	1	Mahogany	The neck is carved and the truss rod inserted, the neckboard is then glued onto it and vacuum pressed together.
Truss Rod	1	Steel	Steel bar that is threaded and glued into neck.
Fingerboard	1	Pau Ferro	Thin layer of wood glued over truss rod onto neck
Body Top	1	Flame Maple	Carved and glued onto body with an epoxy resin.
Pickguard	1	PVC (Polyvinyl chloride)	Injection moulded and screwed into body.
Machine Heads	6	Nickel	Multiple gears encased in a nickel plate cover. Screwed into the headstock.
Nut	1	Plastic	Injection moulded natural polymer that is shaped with grooved for strings and placed into neck.
Bridge and stopbar	2	Nickel	Bolted straight into the body of the guitar.
Pickups	2	Nickel base with magnetic wire wound around alloy pole screws	Hand wound and assembled, screwed into body.
Controls	5	PVC (Polyvinyl chloride)	Placed into body and held in place by the screw under the dial.
Wiring		Copper insulated in Plastic	All electrical components, pickups and controls are soldered together.
Strings	6	Nickel	Strings are held by the bridge and stopbar, then lay over the neck and nut before being wound around the machine heads.

Materials

After taking my product apart, I have analysed the materials used and researched into why they were chosen and how they were processed into becoming part of the full product.

Mahogany is commonly used in the craft of building a guitar. Even though it is one of the more expensive hardwoods it is used because it is attractive with a fairly straight tight grain, easy to work with so can be carved/shaped and it helps to produce warmer tones in stringed instruments. It is used in the body and neck of the guitar.

Steel is an alloy that is mainly made up of iron and carbon. It can be forged into different shaped for many uses such as mechanical, architectural or for just household items. It is used for making the 'truss rod' in modern guitars. The truss rod is used to stabilize and reinforce the neck, this is why steel is a great material for this part as it has a high tensile strength and a low cost. Recently however, some high end guitar luthiers have been using carbon fibre as a replacement material as it has a high tensile strength but also has the extra benefit of being significantly lighter.

Pau Ferro is a wood that comes from Brazil and Bolivia. It is only recently that it has been used commonly. This is because of new laws set in 2017 that affected how the predecessor (Rosewood) was traded across international borders. This caused companies to search for another wood to take its place. Luckily, Pau Ferro is a very suitable choice to use instead as it is tonally very similar. It can be carved and worked to suit many sizes and scale lengths.

PVC (Polyvinyl Chloride) is a synthetic plastic and is one of the most produced plastics. *"Approximately 39.3 million tonnes of PVC were consumed globally in 2013"* - Solheil, T. (2014). PVC is injection moulded so can be used to make an infinite amount of shapes and has many advantages, such as it being resistant to chemicals and it being an electrical insulator. The main purpose of this usage though is that it is lightweight and strong. It is also possible to dye the PVC in many colours to suit the product.

Nickel is a strong metal. It is non corrosive and looks silvery with a gold tint. Therefore it looks luxurious. It is perfect for this use as it stays shiny and is scratch resistant so the strings do not wear down the surface after a lot of use.

Summary

For future of guitars depends entirely on the target market for them and the influences that some people have on them. There are many styles that you can go for to help get the right sound for the individual. On my guitar though with a mid to low range budget, the manufacturer could cut back on finish of the guitar by not having the expensive 'flame maple' veneer and bindings. This could allow them to put more money into the hardware, allowing the guitar to last longer without servicing. This could also provide the user with better playability.

Overall, after the past 100 years the guitar has evolved to suit the player and I believe it will continue to do so for much longer.

Bibliography

Guitarhistoryfacts.com. (n.d.). *History of the Classical and Electric Guitar*. [online] Available at: <http://www.guitarhistoryfacts.com/guitar-history/history-of-the-classical-guitar/> [Accessed 4 Dec. 2018].

SoundUnlimited. (2017). *Guitar Tone Woods*. [online] Available at: https://www.soundunlimited.co.uk/blogs/articles/guitar_tone_woods [Accessed 7 Jan. 2019].

Bhatt, P. and Goe, A. (2017). *Carbon Fibres: Production, Properties and Potential Use*. [online] MaterialsSciencejournal.org. Available at: <http://www.materialsciencejournal.org/vol14no1/carbon-fibres-production-properties-and-potential-use/> [Accessed 7 Jan. 2019].

Andertons Music Co. (2016). *Fender CITES Changes - Rosewood vs. Pau Ferro Fretboards*. [online] Available at: <https://www.andertons.co.uk/fender-cites-rosewood-pau-ferro> [Accessed 7 Jan. 2019].

Solheil, T. (2014). *Study: global PVC demand to grow 3.2% annually through 2021*. [online] PlasticsToday. Available at: <https://www.plasticstoday.com/content/study-global-pvc-demand-grow-32-annually-through-2021/17670326321043> [Accessed 7 Jan. 2019].

Rsc.org. (n.d.). *Nickel - Element information, properties and uses | Periodic Table*. [online] Available at: <http://www.rsc.org/periodic-table/element/28/nickel> [Accessed 7 Jan. 2019].

Epiphone.com. (n.d.). *Epiphone Les Paul Standard Plustop PRO*. [online] Available at: <http://www.epiphone.com/Products/Electrics/Les-Paul/Les-Paul-Standard-Plustop-PRO.aspx> [Accessed 7 Jan. 2019].

Bell, T. (2018). *What Is Nickel? Properties, History, Production & Uses*. [online] The Balance. Available at: <https://www.thebalance.com/metal-profile-nickel-2340147> [Accessed 7 Jan. 2019].

Materials and Construction Methods

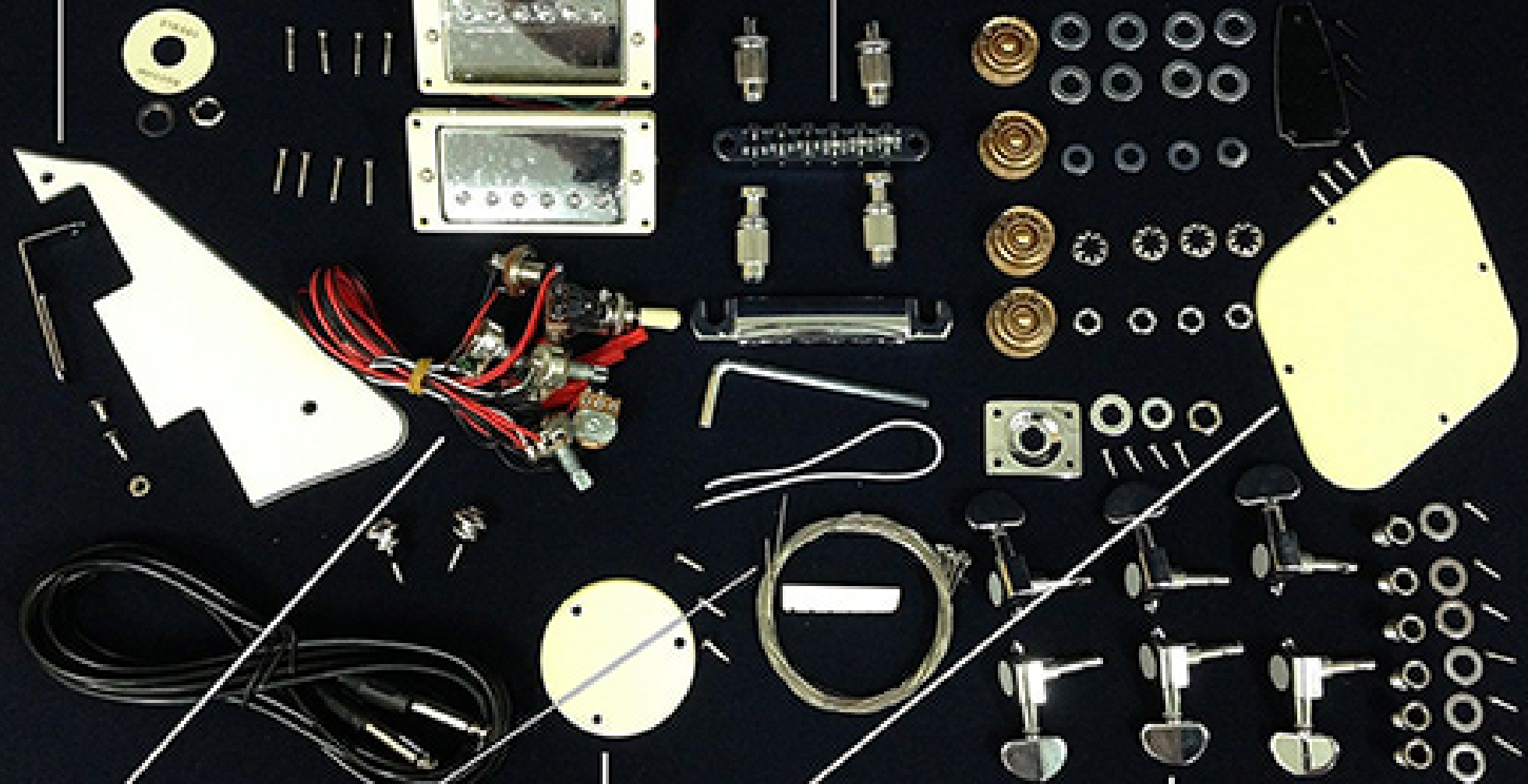


Pickguard - PVC - Injection Moulded.

Pickups - Hand Wound.

Bridge and Stopbar - Nickel, CNC Machined and assembled by hand.

Controls - PVC - injection Moulding.



Strings - Nickel Wound.

Wiring - Copper coated in insulated plastic - Souldered to Components.

Cover Plates - PVC - Injection Moulding.

Machine Heads - Nickel plates surrounding gears.