Deconstructing the Stratocaster

The Fender Stratocaster is arguably one of the world's most famous electric guitars. It was the instrument of choice for music legends Jimi Hendrix, George Harrison, Eric Clapton, and many more, and even today is played by musicians of varying skill level all around the world. As you may have guessed, a good way to describe the Stratocaster is to divide the components making it up into two subsystems. The first subsystem is the 'guitar' part, and includes the parts that make up any guitar, acoustic or electric. After a basic understanding of how guitars work is achieved, then the focus will shift to the 'electric' subsystem. These two subsystems combine to make an electric guitar.

Common Guitar Components

The guitar components of the Fender Stratocaster are the parts that are found on all guitars and most stringed instruments. These are what give the guitar form and allow it to be played.

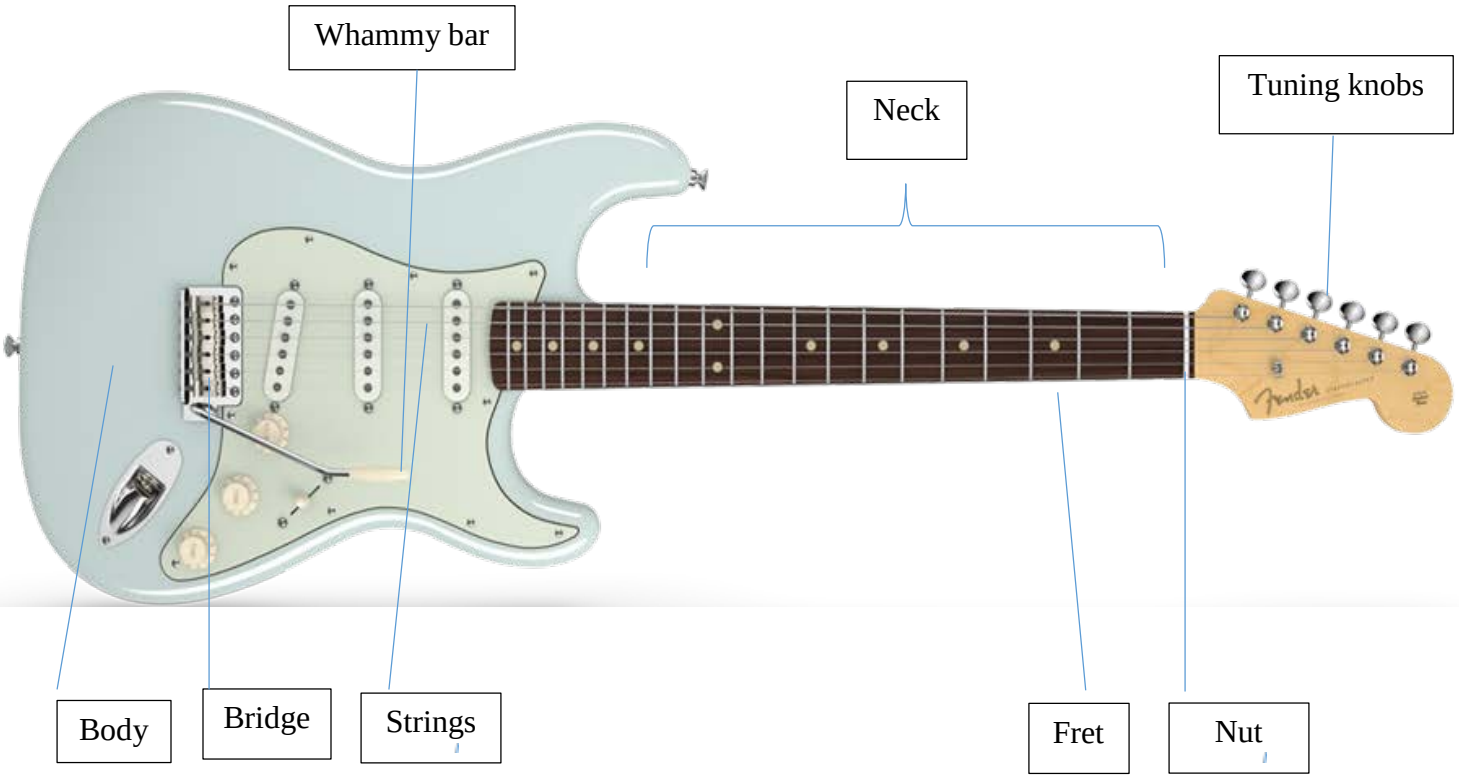

Figure 1: Common Guitar Components

Body

The body is where the guitar is strummed by the guitarist. Fender Stratocasters are typically made from red alder wood. Red alder wood is ideal for electric guitars because it is lightweight, not too dense, and is easily obtainable. These properties inhibit the vibration of the guitar caused by the guitar strings, and leads to less interference with the electrical system. This is different

from acoustic guitars, whose bodies are designed to amplify the vibration of the string. Since the sound from an electric guitar is obtained from an electric amplifier, electric guitar bodies are designed to minimize excess vibration.

Neck

The neck is where the guitarist holds the strings down to choose what notes he/she plays. Stratocaster necks are made of maple, which is harder and more durable than alder. The material making up the neck can affect the type of sound obtained by the instrument, but is not as important to the functionality of the guitar as the body is.

Strings

All guitars have six strings: E, A, D, G, B, E. The sound from the guitar comes from the vibrations that ensue when the strings are plucked. New Stratocasters are made with special strings manufactured by Fender, but different types of strings with varying material properties can be used with the guitar to obtain different sounds. All electric guitar strings are made of magnetic metal, for reasons that will be discussed in more detail later on.

Bridge

The bridge is where the strings are connected to the body. Its purpose is to anchor the strings and allow them to vibrate in the direction they are plucked and prevent them from vibrating longitudinally. It also, in conjunction with the nut, keeps the space between the strings constant. Stratocasters come with a six screw 'synchronized' tremolo bridge, but, like strings, alternative bridges can be installed on the guitar. The guitar pictured in Figure 1 has a **whammy bar**. The whammy bar is attached to the bridge, and allows the guitarist to oscillate the tone of a string while it is vibrating.

Nut

The nut is where the guitar strings are attached to the neck. It shares some of the function of the bridge as it primarily spaces the strings from each other, as well as set the **action** of the guitar, or the distance between the string and the neck. The positioning of the nut and the bridge relative to each other dictate the vibrating length of the strings, and therefore affect the note that sounds when the guitar is plucked.

Tuning Knobs

After the strings are anchored to the nut, they are wrapped around the tuning knobs. These adjust the tension in the guitar strings and allow the guitarist to tune the guitar within a certain range (too tight will snap the strings, too loose won't vibrate).

Electric Components

Electric guitars are designed to have their sound projected through an electric amplifier rather than through their body. Certain electrical components enable the sound to be transmitted to the amp, and can be modified during transmission to change the sound.

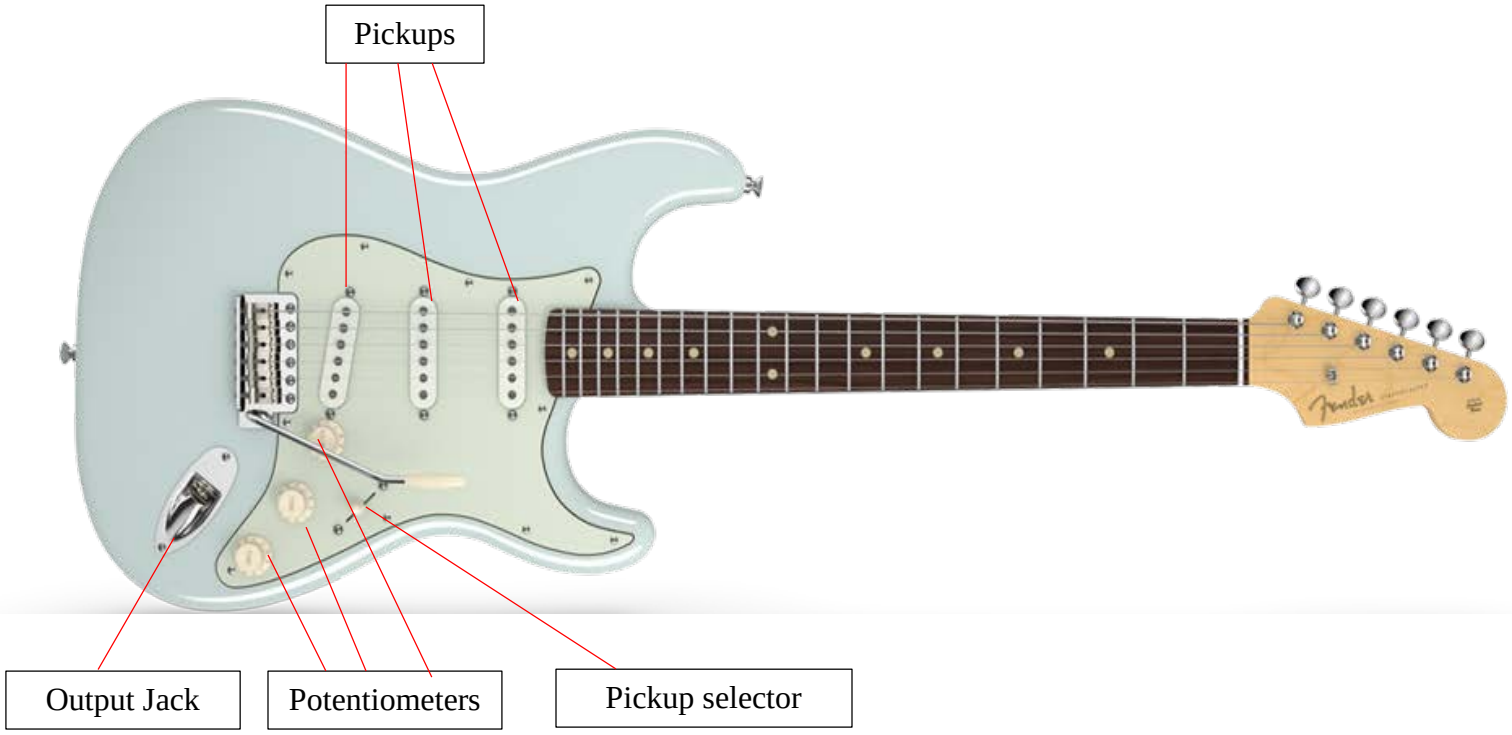

Figure 2: Electric Guitar Components

Pickups

The pickups transmit sound from the strings to the amplifier. The most basic pickup is a bar magnet wrapped in many turns of wire. When the magnetic, metal string vibrates, it disturbs the magnetic field surrounding the magnet. The disturbance in the magnetic field induces an electric current in the wires surrounding it, and that electrical current is transmitted from the pickup to the amplifier through the **output jack**. The Stratocaster pictured has three pickups; one at the neck, one at the bridge, and one in between. The switch on the side of it is a **pickup selector**. Changing the position of the switch will change which pickup transmits the guitar's signal to the amp.

Stratocasters are manufactured with single-coil pickups, but pickups can be changed to alter the sound of the guitar. Single coil pickups are the most basic types of pickups, the other major kind being double coil, or humbuckers. Double coil pick-ups are basically single-coils wired up next to each other to filter out the noise caused by electrical interference.

Pickups and distortion

Distortion is an effect that is heard is most rock songs, and is caused when the output signal from a pickup is too strong for the amplifier circuitry to receive. This causes the electrical signal to become distorted, and when the amplifier converts the electrical signal back to a sound wave, it does not sound like a normal guitar. Aside from single and double coil, pickups are generally classified by their output.

Potentiometers

The knobs on the side of the guitar are potentiometers. Potentiometers are essentially variable resistors. Electrical signals from guitar pickups are just alternating currents caused by vibration, and the signal has a corresponding voltage. According to Ohm's law, voltage is equal to resistance multiplied by current, or $V = IR$. By changing the resistance with a potentiometer, the guitarist can alter the properties of the electrical signal, and enable more control over the tone and volume of the sound.

Conclusion

Fender Stratocasters are comprised of a number of parts that all serve to produce a desired sound. The solid alder body reduces the excess vibrations transmitted to the pickups. The bridge, nut, and tuning knobs allow the guitarist very fine control over the tone of the sound. The pickups and potentiometers allow for further modification of the sound while it is being transmitted from the strings to the amplifier. In the same way that the pickups amplify the sound from an electric guitar, the Fender Stratocaster has amplified the talent of legendary musicians, and has been instrumental in the creation of music history since its debut.