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PART 1: THE HISTORY OF GUITAR GEAR

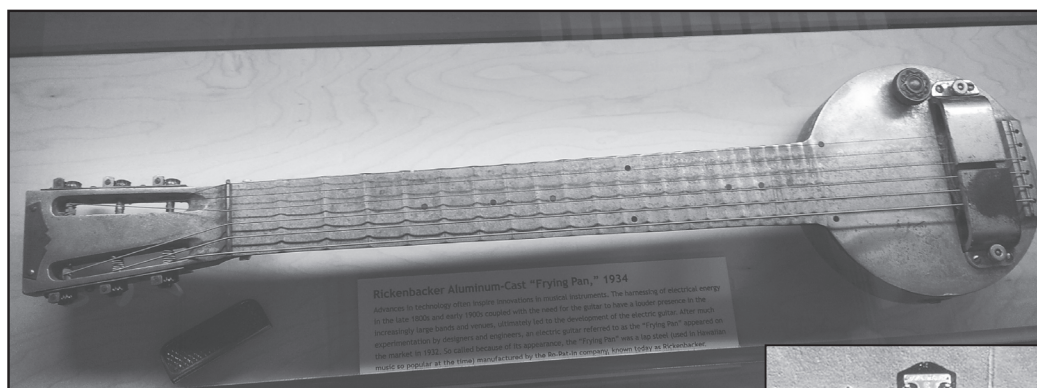
THE 1930s

Despite the stock market crash of 1929, which plunged America into the Great Depression, the 1930s were a time of significant technological innovation on multiple fronts. Along with the invention of frozen food, color film, the chocolate chip cookie, and a host of other conveniences, the electric guitar was born in 1931.

The First Electric Guitars

Jazz guitarists, such as Eddie Durham, Charlie Christian, Les Paul, and George Barnes, as well as Hawaiian slide players, needed to be louder to cut through the band. Many had tinkered with various methods of attaching microphones to banjos, violins, acoustic guitars, and other instruments, but it seems the “Frying Pan Guitar,” invented by George Beauchamp, claims the distinction of being the first truly electric guitar. Beauchamp had also helped to develop the Dobro Resonator Guitar and co-founded the National String Instrument Corporation, through which he was acquainted with Rickenbacker, who would soon be manufacturing the first mass-produced electric guitars. The Hawaiian lap steel guitar pictured below (officially the model A-22 manufactured by Rickenbacker Electro Instruments) was the first electric guitar and earned its nickname due to its obvious resemblance to a frying pan.

Photo by Doryfour



“The Frying Pan.” Note the two large magnets that acted as pickups on this aluminum-bodied guitar.

The ripples of this important invention would be felt around the world, particularly in country music, which is now difficult to imagine without the inclusion of electric slide guitar in its many forms, be it the lap steel, pedal steel, or bottleneck slide. Close on the heels of the A-22 came the Electro Spanish Guitar, also by Rickenbacker, pictured to the right.

The Electro Spanish Guitar.



Photo Courtesy of Eben Cole/Cole Music Company

Guitar-Based Video Games

In 2005, electronic entertainment company RedOctane released the *Guitar Hero* video game, and suddenly there was vast renewed interest in guitars and guitar-driven music. *Guitar Hero* was followed by the *Rock Band* video game by Harmonix, and perhaps even inspired Ubisoft's 2012 game *GuitarSmith*, which allowed the user to plug in a real electric guitar and play! These fun inventions provided a much needed shot in the arm for recession-weary music merchandisers everywhere!

Look, Ma, No Amp!

In the post-2000 era, there was a growing movement away from amp dependence. Many players, such as Misha Mansoor of Periphery, didn't use amps at all any more and simply plugged a studio-grade modeling processor straight into the P.A. system or the monitors of a home recording studio. This eliminated the need for amps, pedals, speakers, and microphones.

The device of choice of tech-savvy tone geeks appeared to be all-in-one units that could serve as a live direct box, an interface to a computer environment, a multi-effects processor, and an amp modeler. Many such devices exist, including the Fractal Audio Systems Axe-FX released in 2006, Digidesign 11 Rack in 2009, and Digitech iPB-10 released in 2010. The iPB-10 acts as a docking and control station for the Apple iPad. All of these units are powerful tools for the modern guitarist and provide a vast array of features and capabilities, which may sometimes not be easily accessible without considerable effort on the part of the user. That said, the younger the user, the easier the job, usually—due to the increasing familiarity with computer-based technologies by younger users.

Fractal Audio Systems Axe-FX II

So where has nearly 100 years of electric guitar tone evolution finally led us to in the 2010s? The Fractal Audio Systems Axe-FX II, now in its 3rd generation, has risen to the top as, arguably, the best all-in-one guitar rig available. It's a two-space rack unit that can be connected to any computer via a USB cable, so editing can be done on a full-sized screen or on the unit's front panel LED display. Two kinds of software are used with the Axe-FX II: Firmware, which is the software onboard the unit, and Axe Edit, which must be downloaded to a computer and is used to program the unit and organize the patches. The software evolves very quickly, and updated versions of both are released frequently. The downloading and installation of these updates adds more features and better tone quality to the unit. This is the result of a fast-moving R&D (research and development) team and constant feedback from active online user forums, where players swap patches, ask each other questions, report bugs, and request new features from Fractal. Historically, a new physical unit was released when the CPU power of the old version could no longer handle the demands of the new software.

Photo courtesy of Fractal Audio Systems



Fractal Audio Systems Axe-FX II.

ELECTRONICS

Guitar electronics can range from the very simple single humbucker, single volume knob approach championed by Eddie Van Halen on his infamous “Frankenstein” guitar to the marvelously complex controls and active preamps on a 1970s B.C. Rich Bich guitar. Most players and manufacturers choose something more moderate, with the two classic setups being that of the Fender Stratocaster and the Gibson Les Paul. Of course, many other options are available. Paul Reed Smith, Gibson, B.C. Rich, and others offer five-position rotary knobs, tone switches, phase inverters, coil taps, kill switches, active preamps, and more. We’re going to explore the two classic setups first.

Photo by Bainzy



The Eddie Van Halen “Frankenstein” guitar has minimal electronics.

Photo by Coyte182



The Tom DeLonge Signature ES-335 has minimal electronics.

Photo by Pat Guiney



Jerry Garcia “Rosebud” guitar with complex electronics.

Photo courtesy of Hanser Music Group

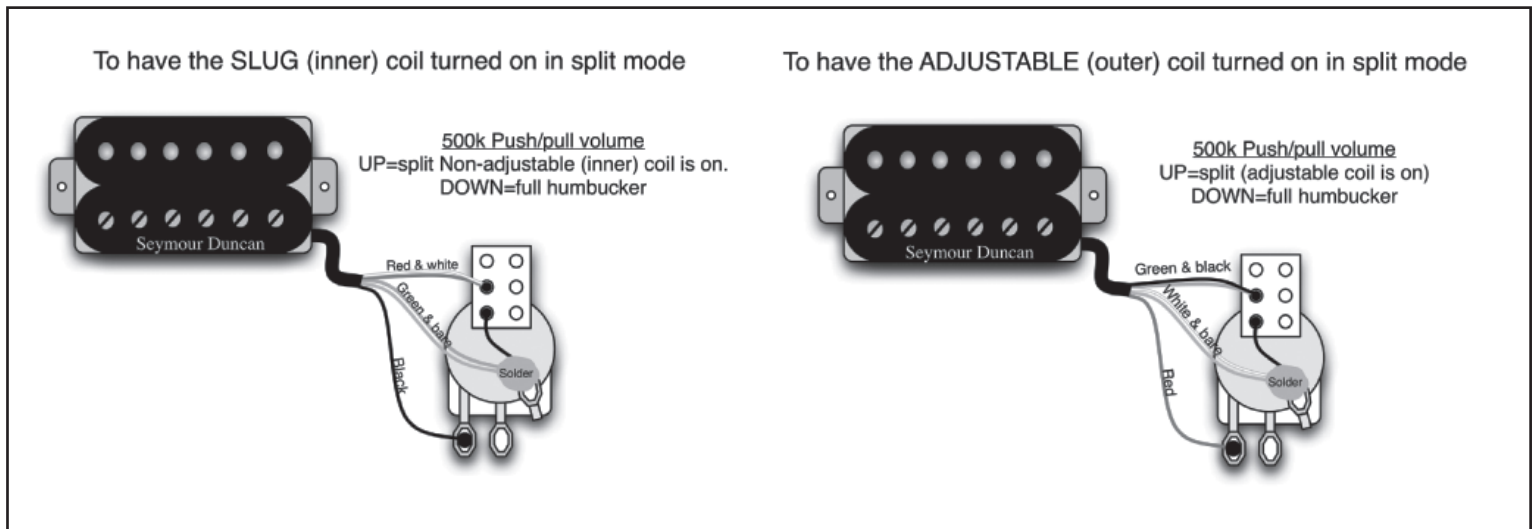


B.C. Rich Bich 10-string guitar features two active-boost circuits with individual controls.

Coil Tapping and Splitting

Coil *splitting* is often mistakenly referred to as coil *tapping*. Coil splitting disengages one of the two pickups inside a humbucker so that it sounds like a single coil. It is often activated by a push-pull potentiometer (that is doubling as the volume or tone knob) or via a simple mini toggle switch. This is a common modification that will come stock on many guitars. As Strat players load their guitars with humbuckers and add kill switches to make them more versatile, Les Paul players will add coil splitting to get closer to the clean Strat tones.

Diagram courtesy of Seymour Duncan



Seymour Duncan coil splitting diagram.

Coil tapping is quite different. Here, a portion of a single-coil pickup, often the bridge position, is tapped into to slightly color the overall sound, making it quieter, clearer, yet purely Stratty in a good way. Switching from the tapped pickup to the full-on one with a little gain on the amp can take you from crystal clean to mean in a heartbeat! This cool procedure is mostly overlooked; people who refer to coil tapping are often talking about coil splitting.

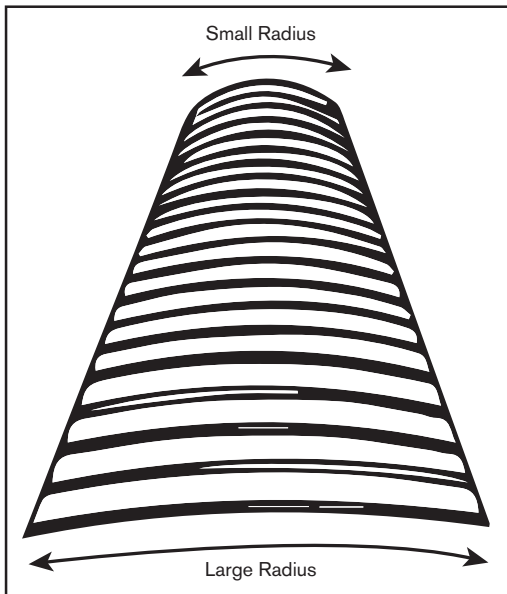
Photo courtesy of Seymour Duncan



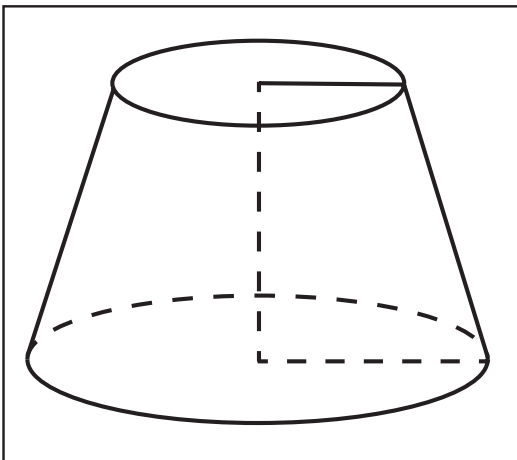
Custom staggered SSL-5 with tapped version available for dual output levels.

Compound or Conical Fretboard Radius

Some luthiers have attempted to create a best-of-both-worlds scenario by crafting fretboards with a diminishing radius. The lower part is curved more to make rhythm playing easier, while the high part is flatter to facilitate bending and scale runs. The radius for these guitars changes smoothly since it is modeled on a cone, not a circle. The diagrams below illustrate this concept.



Compound radius fretboard. The higher frets are less curved than the lower frets.



The cone model helps the luthier achieve a smooth radius change because the circles evenly diminish in size as they rise up the cone.

The following chart shows the fretboard radius of various guitars.

Guitar Neck Radius Guide

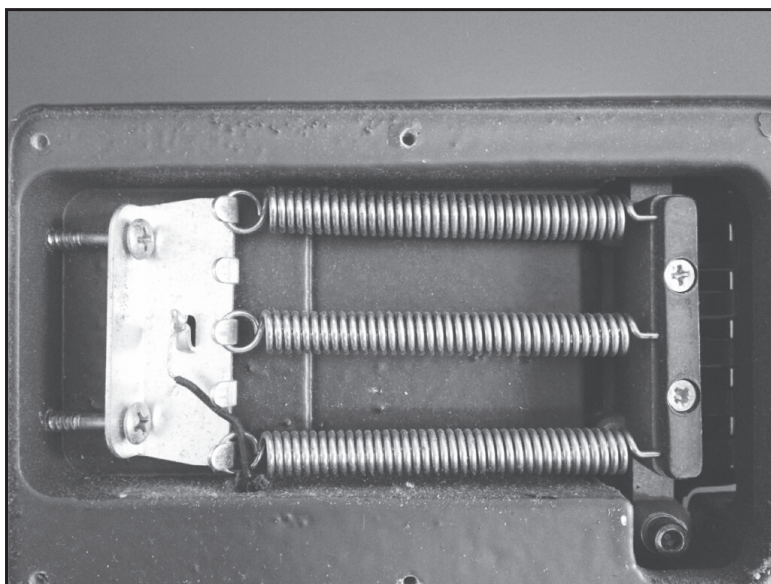
GUITAR	RADIUS
Classical Guitar	Flat
Vintage Fender Strat	7.25"
Modern Fender Strat	9.5"
PRS Custom 24	11.5"
Guitars with Original Floyd Rose Locking Nut	10"
Gibson Guitars	10" to 12"
Ibanez Guitars	12"
Jackson Guitars	16"

Locking Down a Trem (Blocking)

Many players have guitars with whammy bars they don't ever use. If the bar is *floating*, you'll encounter tuning problems when you break a string, and the pitches of other strings will change when you play harmonized bends—not to mention the hassle of having to constantly loosen and tighten the locking nut.

The tremolo system features a rectangular metal block that extends down into the guitar's body with springs attached to it. In a floating setup, the block can move a short distance in either direction before resting against the edge of the cavity of the guitar body. A block of wood or material such as cork or cardboard can be fitted into the spaces around the metal block to immobilize it. This keeps the bridge in one position and deactivates the whammy bar. This is called *blocking* the trem. If you don't use the bar, the best thing to do is block, or lock down, the trem. After blocking the trem, you can remove the whammy bar itself, the springs, and the locking parts of the nut, and the guitar will function more efficiently. It is very easy to unblock a trem to return the guitar to its original condition.

Photo by Tobias Hurwitz



Unblocked floating trem.

Photo by Tobias Hurwitz



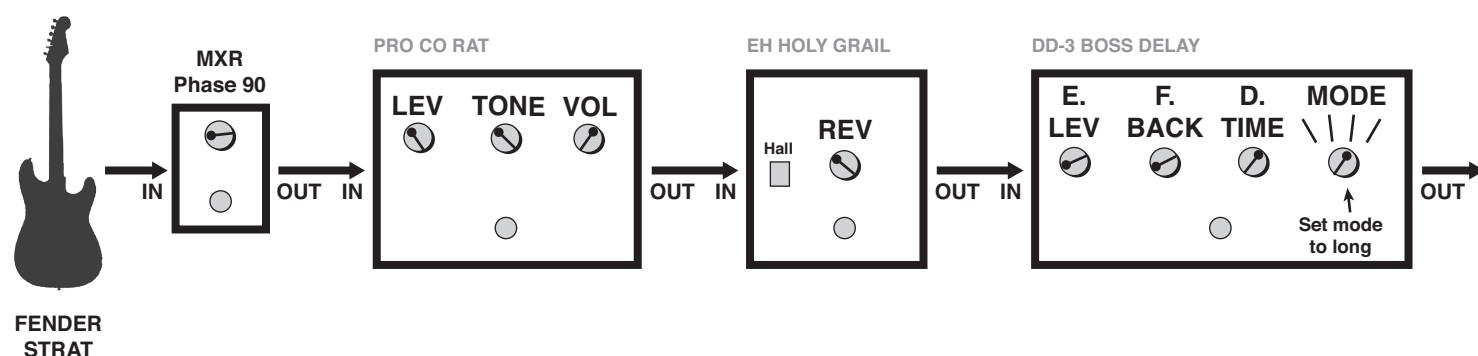
Blocked floating trem.

PHYSICAL AND VIRTUAL EFFECTS

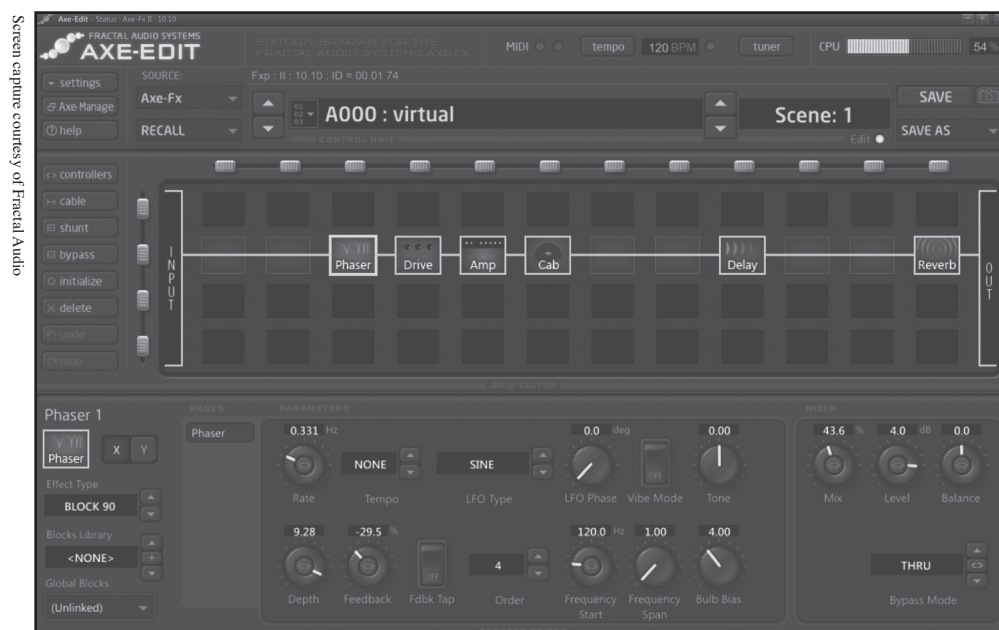
Knowing about physical effects will be tremendously useful when you have to program their counterparts in the virtual world. As we already know, physical effects exist in every form—from stomp boxes and tape echoes to rack-mounted units and everything in between. Play with the knobs on stomp boxes and get to know the wiring of amps, mics, and pedalboards. The experience gained will help you better understand virtual effects when you encounter them in plug-ins and software.

Since the names of the actual effects units are trademarked, companies like Line 6 and Roland use clever monikers to refer to the gear they are emulating. For instance, a “Script Phaser” is a clone of a vintage MXR Phase 90 that features the script logo. A “Modern California” amp refers to a Mesa/Boogie Mark IV, or similar, amp.

Below, we have illustrated a simple signal chain on a pedalboard.



Here is the same signal chain as above but displayed on the “grid” page of the Axe-Edit software provided by Fractal Audio Systems for their Axe-FX II processor. When you click on an individual pedal in the software, its controls are accessed via a drop-down screen. Note how the virtual compressor has the same three knobs as the real one.



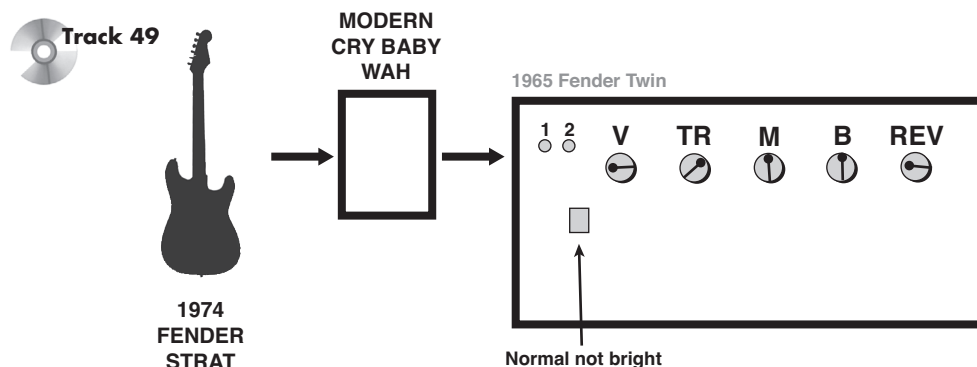
Axe-FX II screen.

The Funk Sound

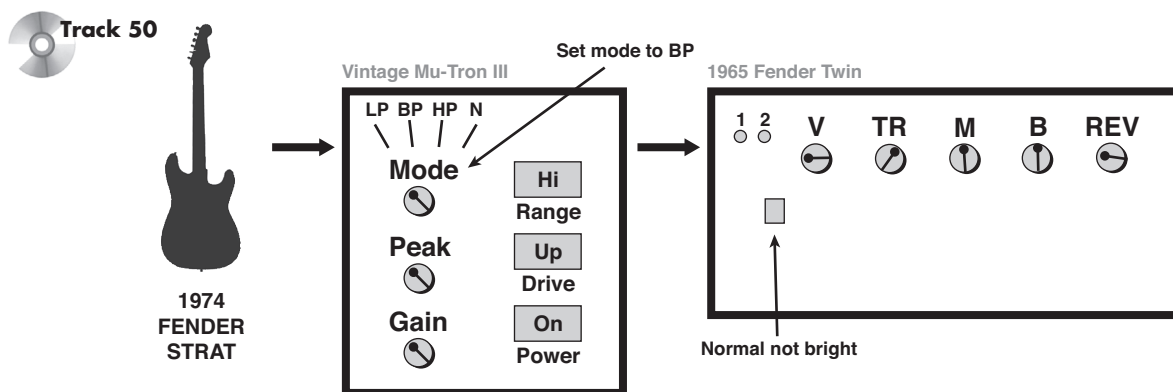
There's a quirky intensity among funk artists that is sometimes mirrored in their guitar tones. If you recall members of Funkadelic dressing only in giant-sized diapers or the The Red Hot Chili Peppers running onto stage with tube socks as their only garb, you'll get the idea. The funk pantheon also includes colorful characters like George Duke, Bootsy Collins, Earth, Wind & Fire, Sly Stone, Stevie Wonder, Isaac Hayes, Wild Cherry, Stanley Clarke, Prince, Chaka Kahn, and countless others.

Signature funk tones usually come into play with clean rhythm guitar since the leads are almost always '70s style hard rock. These rhythm patterns are often based on syncopated sixteenth-note strumming and the layering of *ostinato* grooves. (The term "ostinato" refers to accompaniment patterns that are repeated.) The tones include standard clean Strat sounds with wah, phaser, and compressor.

Think of Isaac Hayes' theme song to the movie *Shaft*. The clean wah riff on the rack is typical of the classic funk style. Try playing octaves in a syncopated sixteenth-note groove while tapping your foot in quarter notes on the wah—you're a funk master! Check out the setup below and listen to Track 49 for our demonstration.



Here's another great funk tone.



These settings yield an envelope sensitive (see note below) clean attack that screams funk with every note. If you don't have a mini Q-Tron, you can substitute a Boss Auto-Wah, Mu-Tron III, or a Pigtronix Envelope Phaser. Funk out!

Note: Envelope sensitive effects react differently to the dynamics of a player's picking. In the case of the Mu-Tron III, the harder the picking, the more pronounced the wah effect.