



PICKUPS

TREMOLO ARM

PICKUP
SELECTOR
SWITCH

CONTROL KNOBS

BRIDGE

VOLUME

TONE

INPUT JACK

The business end of a Fender Stratocaster, seen here on a well-worn 1965 model, has not changed much in almost 50 years.



THE **ELECTRIC** GUITAR

HOW WE GOT FROM ANDRÉS SEGOVIA TO KURT COBAIN

BY MONICA M. SMITH

SOME THINGS WERE INVENTED FOR OBVIOUS REASONS. With others, the motivation is less clear. Consider, for example, the electric guitar. When guitarists first crudely electrified their instruments in the 1920s, what were they trying to do? Why change something that had been successful for hundreds of years? Could they have envisioned that the instrument that inspired some of Vivaldi's and Boccherini's most beautiful compositions would one day be used by Motörhead and blink-182?

In fact, the driving force behind the invention of the electric guitar was simply the search for a louder sound, a desire that had existed long before the development of electronic amplifiers and speakers in the 1920s. As musical performances moved to increasingly large public spaces over the course

Germany in 1796 and immigrated to the United States in 1833. During the 1850s Martin developed X-bracing, the use of crossed wooden strips in the guitar's top for structural reinforcement. He also developed other design features, such as a body shape that was smaller above the sound hole than below.

In the late 1890s Orville Gibson, founder of the Gibson Mandolin-Guitar Manufacturing Company, designed a guitar with an arched (or curved) top, as is found on a violin. It was both stronger and louder than the earlier flat-top design. (The top of a guitar is the side with the strings.) It helped, but guitars were often still hard to hear.

The quest for volume intensified during the 1920s with the advent of big-band music and commercial radio and the rise of the recording industry. By the end of

from the banjo, he designed a metal-body guitar with metal resonating cones built into the top. Unlike earlier acoustic guitars, this one's sound was created by the vibrations of the resonator cones, not those of the body itself. Resonator guitars produced a loud, brash tone that was popular with some Hawaiian and blues guitarists but was unsuitable for many other types of music.

Another solution was to use steel strings instead of gut. The guitar had to be altered structurally to withstand the increased tension of the heavier strings, and in many cases this meant ever-larger bodies with more internal bracing and stronger necks. The C. F. Martin Company became known in the 1930s for its Dreadnought, a large steel-string flat-top acoustic guitar that was widely imitated by other makers, including Gibson.

These mechanical fixes helped, but only up to a point. So guitarists began to look at the possibilities offered by the new field of electronic amplification, which had been made possible by recent advances in vacuum tubes. Simply putting a microphone in front of the guitar would work in a solo setting or a small group, and this method is still common among folk singers. But in a big band, the microphone would amplify the rest of the band nearly as much as the guitar. What guitar players needed was a way to separate the guitar's sound and boost it in isolation.

Guitar makers and players began experimenting with electrical pickups. On today's electric guitars, a typical pickup consists of a permanent bar magnet that is wrapped tightly with a coil of wire. The ends of the coil are connected to an amplifier. When a metal string vibrates next to the pickup, the bar magnet's field induces an electric current in the string. The current varies rapidly as the string vibrates back and forth. This

varying current, in turn, creates a varying magnetic field of its own, which induces a current in the wire coil. That current, called a signal, is boosted by the amplifier and then used to create sound waves by making a speaker cone vibrate. Instead of a single large magnet, a pickup may contain a series of magnets, sometimes one for each string, but they will usually all be wrapped with the same coil.

The first guitar pickups were much less refined. A Gibson engineer named Lloyd Loar, a musician himself, developed a functional coil-wound pickup as early as 1923, but Gibson was not yet interested in producing electric instruments, so it never introduced Loar's invention onto the market. Even if it had, the technology needed to amplify the signal and reproduce it through loudspeakers was still a few years away from being commercial.

Loar's pickup was not electromagnetic in the modern sense. Instead, it used the instrument's physical vibrations, as transmitted through the bridge, to vibrate a diaphragm stretched over the pickup and create an electrical signal. The first commercially advertised electric guitar, offered by the Stromberg-Voisinet company of Chicago in 1929, used a similar pickup connected to the soundboard. Both systems had trouble creating a strong enough signal. In 1933 Loar began marketing electric guitars, mandolins, and keyboards under the Vivi-Tone label, but he found few buyers.

The guitarist Les Paul also started experimenting with electrical amplification in 1929. Still in his early teens, he jammed a phonograph pickup into his acoustic guitar, slid a telephone mouthpiece under the strings, and wired them to his parents' radio, which he used as an amplifier. The experiment was not immediately successful. Among other things, a conventional guitar's sound is meant to resonate through its body and be

Sol Hoopii plays a Hawaiian lap steel around 1951; Charlie Christian solos with the Benny Goodman Sextet in 1940 (Lionel Hampton is on vibes).



WHAT GUITAR PLAYERS NEEDED WAS A WAY TO SEPARATE THE GUITAR'S SOUND FROM THE REST OF THE BAND AND BOOST ITS VOLUME.

heard from the outside, so amplifying the vibrations directly under the strings gets the acoustics all wrong. Still, it inspired Paul to embark on a lifelong dual career of performing and engineering. He went on to pioneer multitrack recording and sound-on-sound techniques and develop many devices and methods to expand the electric guitar's capabilities and revolutionize the recording industry.

Trying to name a single inventor as the first to build a modern electric guitar would be fruitless, but the credit for making the technology commercially viable goes to the Rickenbacker International Corporation (originally the Ro-Pat-In Corporation and then the Electro String Instrument Corporation). The company was founded by George Beauchamp (pronounced "Beechum") and Adolph Rickenbacker, a distant cousin of the World War I flying ace Eddie Rickenbacker. Adolph's name was originally rendered Swiss-style as Rickenbacher, and this spelling was used on the company's earliest guitars.

In late 1931 Beauchamp built an electromagnetic pickup by placing a pair of horseshoe magnets end-to-end to create an oval, which wrapped around the strings. The coil was placed inside the oval as well, underneath the strings. Since it did not depend on physical contact with the vibrating guitar body, this pickup had a much cleaner sound and a stronger signal than earlier models. The horseshoe pickup was introduced on the market in a hollow cast-aluminum lap-steel guitar nicknamed the *Frying Pan* because the playing area consisted of a small round disk. The *Frying Pan* (officially called the *Electro Hawaiian*) was the first commercially successful electric guitar.

Most early commercial electric guitars were Hawaiian, or steel, versions. The Hawaiian lap guitar, introduced to the mainland around 1900, differs from the standard Spanish-style guitar in that it is played horizontally, on a stand or in the player's lap, and has a sliding steel bar that can be moved along the frets for a glissando effect. The ease of learning and playing the Hawaiian guitar made it popular with users and teachers. Its alluring effect of sliding between notes particularly endeared it to Hawaiian, country, and blues musicians. The Hawaiian guitar was especially prominent in American music in the 1920s and 1930s.

Beauchamp filed his first patent application for the *Frying Pan* in 1932, shortly before it went into commercial production. A second, greatly revised application was submitted in 1934, but it ran into problems. Although the *Frying Pan* was already on the market, two successive patent examiners questioned whether the instrument was "operative." To

prove that it was, Rickenbacker sent several guitarists, including the well-known Hawaiian musician Sol Hoopii, to perform for the examiners at the Patent Office in Washington, D.C. The patent was finally granted in 1937. By that time other inventors had developed and marketed electric guitars of their own.

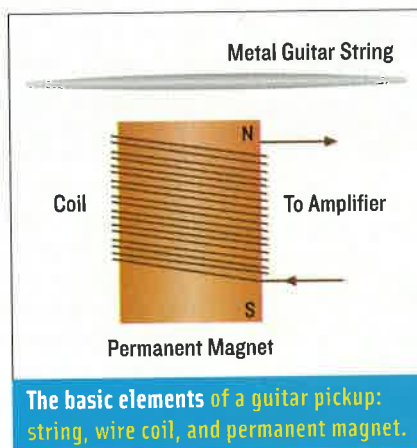
The Gibson ES-150 (E for Electric and S for Spanish), introduced in 1936, was the first Spanish-style electric guitar to achieve commercial success, with most of its sales going to professional musicians. Its pickup was much more elegant-looking than Rickenbacker's bulky horseshoe version. Instead of wrapping around the strings, this bar pickup had two long magnets mounted below the guitar's face, leaving only a small coil-wrapped metal rod visible beneath the strings.

By the end of the 1930s electronic amplification was firmly established as the best way to make a guitar louder, despite some misgivings among traditionalists. Detractors complained that it did not produce a pure, "authentic" tone, and in a sense they were right: Bypassing the resonance created by the hollow body meant altering the instrument's traditional timbre. But musicians were championing the electric's louder sound, which enabled the guitar to compete with other instruments in ensemble performances.

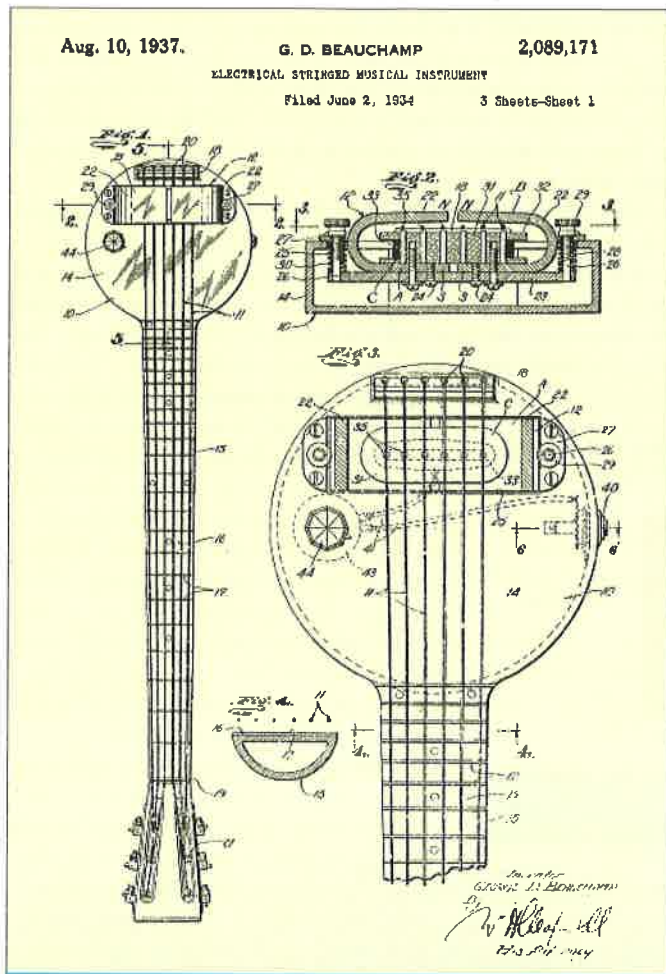
Instead of trying to duplicate the warmth and lushness of an acoustic guitar, musicians and engineers tinkered with their equipment and ended up creating an entirely new kind of sound.

The jazz musician Charlie Christian is generally credited with introducing the electric guitar solo. In 1939 he joined Benny Goodman's band and began stepping to the front of the band and performing long, complicated passages that imitated the style of horn playing. He explained, "Guitar players have long needed a champion, someone to explain to the world that a guitarist is something more than a robot pluckin' on a gadget to keep the rhythm going." Christian's role in popularizing the electric guitar among musicians and the public, and his association with the Gibson ES-150, led to its pickup's being nicknamed the "Charlie Christian pickup."

Yet along with its benefits, the new technology brought problems. Reverberation of the sound through the instrument's hollow body, which was responsible for the guitar's lovely timbre when played acoustically, caused distortion, overtones, and feedback when combined with electromagnetic pickups. But as the electric guitar developed its own sonic qualities and style of play, musicians and manufacturers realized that it should be designed from scratch with amplification in mind. This led a few innovators to think about



EVERYTHING ABOUT THE FENDER TELECASTER'S PATENTED, PRACTICAL DESIGN WAS OPTIMAL FOR PRODUCTION IN LARGE QUANTITIES.



Beauchamp's patent on the frying Pan guitar includes the bulky horseshoe pickup (top right), with its pair of U-shaped magnets.

replacing the hollow body with a solid one.

Some experts argue that the Rickenbacker Electro Spanish, introduced in 1935, was the first Spanish-style solid-body electric guitar, even though it did not actually have a solid body. Parts of it were hollow, but solely in the interest of reducing weight. In design and performance, it functioned as a solid-body guitar, virtually eliminating the acoustic feedback that plagued early hollow-body electrics. It was made of Bakelite, the first synthetic plastic, which, because of its weight, resonates less readily than wood. The Electro Spanish had stainless-steel cavity covers to hide the hollow parts of the guitar, a detachable neck, and horseshoe pickups. Because Bakelite is very heavy, it was smaller than other guitars of the period, and it must have been awkward to play.

However, since the Rickenbacker Electro Spanish was not intentionally conceived of as a solid-body guitar, the credit for inventing the solid-body goes to others, including Les Paul.

In 1941 he made a solid-body guitar that he dubbed "The Log" by attaching a Gibson guitar neck to a four-by-four-inch pine board about a foot and a half long and fitting it with strings and two homemade pickups. Later he cut up and glued the body of a traditional acoustic guitar to the board to make it look slightly more conventional.

Then around 1947 Paul Bigsby, a Los Angeles machinist, teamed up with the country singer and guitarist Merle Travis to design a solid-body electric guitar that more closely resembled the ones we know today. Bigsby also developed a tremolo arm, sometimes known as a vibrato arm or whammy bar, that altered the pitch of notes by changing the tension on the strings when it was moved up and down.

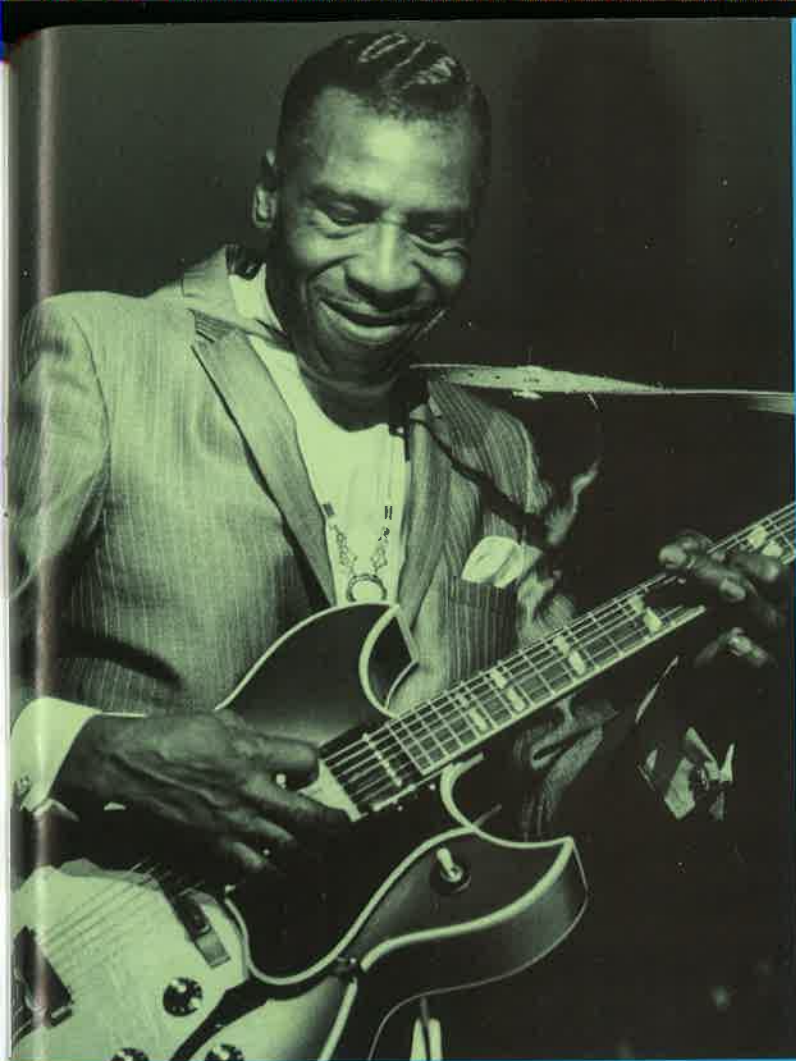
But it was Leo Fender who first successfully mass-produced and sold a solid-body Spanish-style electric guitar. His simply constructed Fender Broadcaster of 1950 (renamed Telecaster in 1952 as the result of a trademark dispute), with its bolt-on neck, was initially derided by competitors as too simple and lacking in craftsmanship. Gibson's president, Ted McCarty, dismissed it as a "plank guitar." Yet everything about its patented, practical design was optimal for production in large quantities. The Broadcaster/Telecaster was immediately successful, spurring other guitar companies to follow Fender's lead.

Some dispute remains about whether the Broadcaster's design was adapted (or stolen, depending on one's viewpoint) from the Bigsby/Travis guitar. We do know that Leo Fender was already familiar with the concept of solid-body construction, since he had made lap-steel guitars out of solid planks of wood in the 1930s and 1940s. In any event, Fender was the one who made the solid-body electric guitar cheap enough for the masses; people called him the Henry Ford of the Electric Guitar.

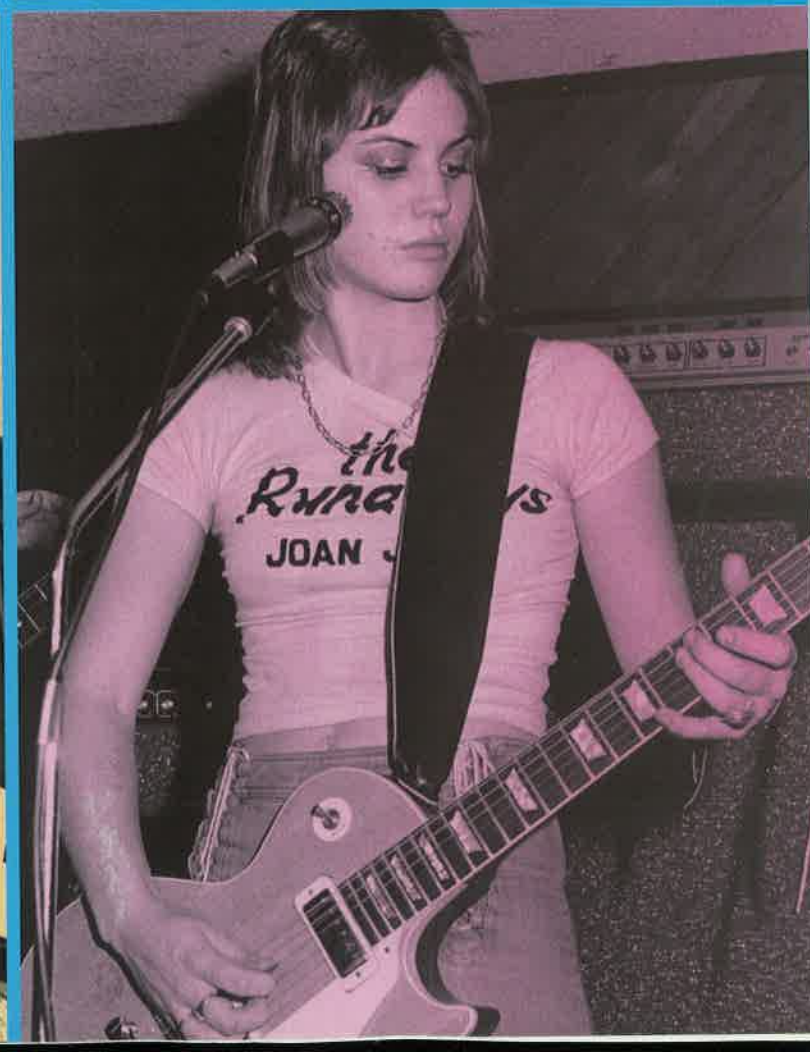
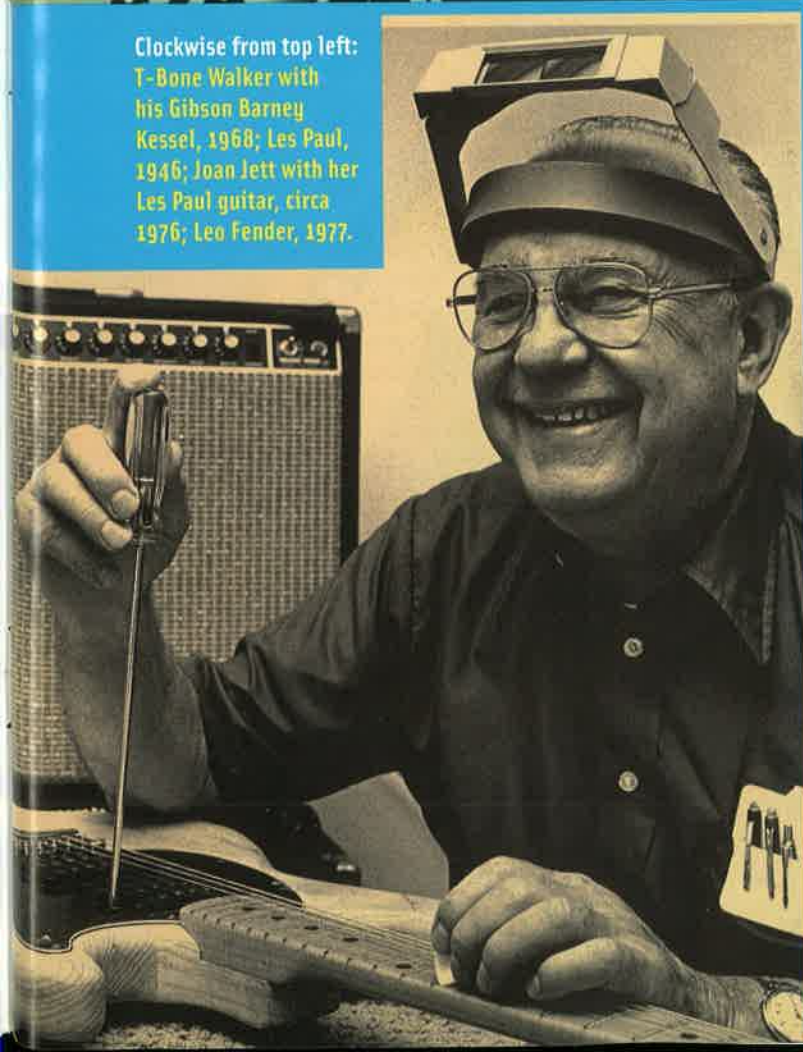
Fender revolutionized the music world again with his 1951 electric Precision Bass. Although there had already been electric standup basses, the "P Bass" was the first commercially successful model to be played like a guitar. (Paul Tutmarc, of Seattle, had built electric guitars, including basses, starting in the mid-1930s and sold them through his company, Audiovox Manufacturing, but they were never widely used.) The Fender Precision had frets like a guitar, making it easier for players to hit an exact note, hence the name Precision. Monk Montgomery, the bassist with Lionel Hampton's band, is credited with making the instrument a musical sensation, and even today *P Bass* is often used generically for any electric bass guitar.

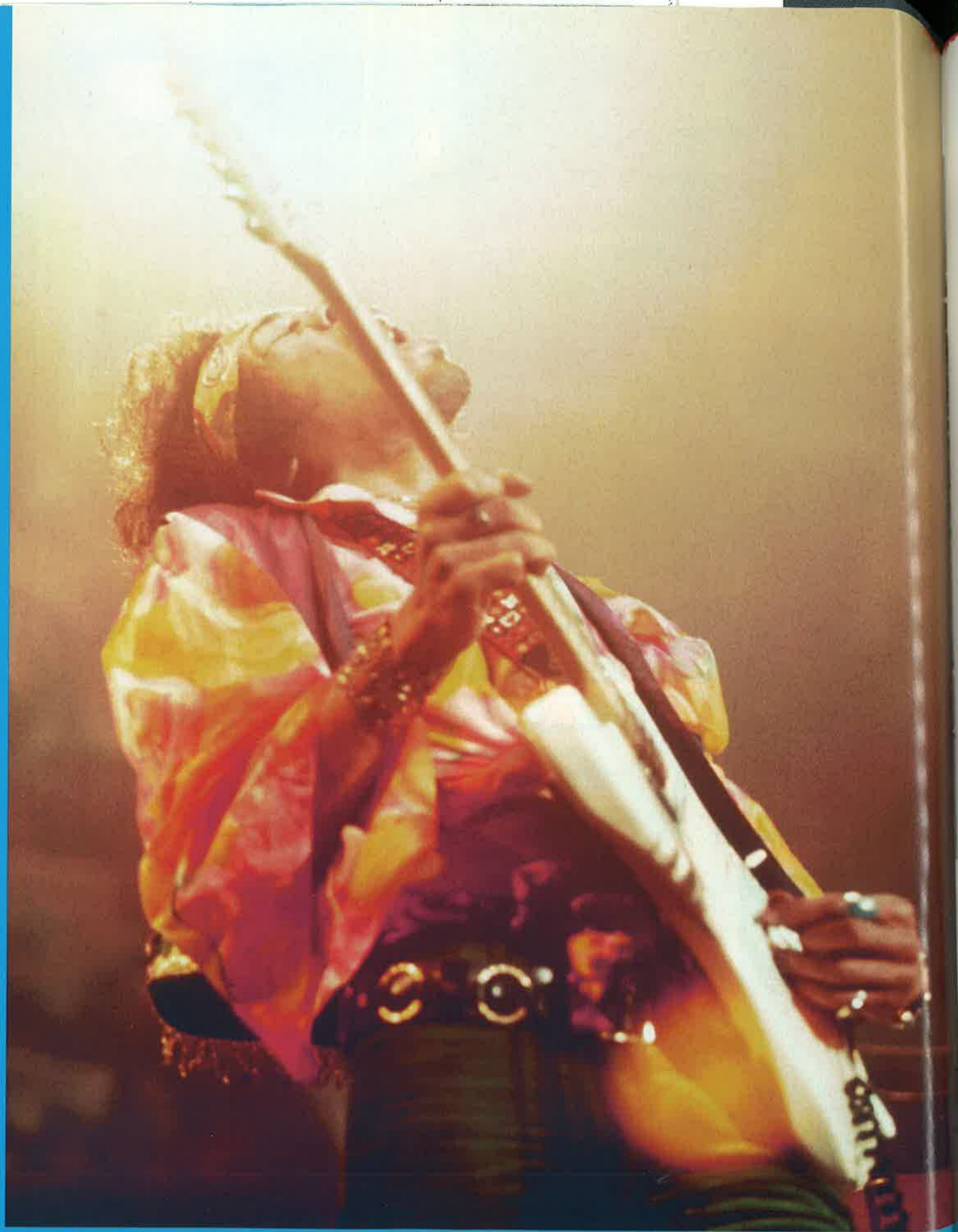
Not only was the Precision cheaper to buy and easier to learn than a standup bass, but by being much more portable, it helped the bass guitar develop into part of the standard lineup of a rock band. Some historians suggest that entire genres of music, such as reggae and funk, could not exist without the electric bass.

In 1952 Gibson became Fender's first major competitor in the solid-body market. The Gibson Les Paul was created in direct response to the success of Fender's Broadcaster/Telecaster



Clockwise from top left:
T-Bone Walker with
his Gibson Barney
Kessel, 1968; Les Paul,
1946; Joan Jett with her
Les Paul guitar, circa
1976; Leo Fender, 1977.





Jimi Hendrix and his Stratocaster at London's Royal Albert Hall, February 1969. Hendrix was known for incendiary performances—sometimes literally.

BEGINNING IN THE 1940s, A NEW, URBAN-EDGED STYLE OF BLUES, BORN IN CHICAGO, WAS BUILT ENTIRELY ON AMPLIFIED SOUND.

model. It was primarily designed by Gibson's Ted McCarty, but it was endorsed by Les Paul, who had been a popular guitarist since the mid-1930s. Paul's design input to the Gibson apparently included the original trapeze-style combination bridge-tailpiece, which allowed him to damp the strings with his hand, and the gold finish, which inspired the instrument's nickname, the Goldtop. The gold color was intended in part to disguise from competitors that the guitar had a maple cap on a solid mahogany body. According to a company history, the idea of using two kinds of wood was to "balance the bright attack of maple with the warmth and richness of mahogany."

After its introduction, the Gibson Les Paul went through a variety of modifications that culminated in 1958 in the still beloved Standard, with its sunburst finish and newly perfected double-coil, or humbucking, pickups. The humbucking pickup transmits less background interference, or hum, from electrical equipment, which can be a particularly annoying problem during recording sessions. It also cuts out some high frequencies, yielding a "warmer" sound that may be desirable or undesirable, depending on the music and the performer.

Fender responded to the success of the Goldtop by introducing the Stratocaster in 1954. This model may be the most influential electric guitar ever produced. It is easily identified by its double cutaway design and three pickups; previous guitars had two at most. (Since the strings vibrate differently at different points along their length, each pickup has its own character, and they can be combined in various ways, in or out of phase, to create numerous effects.) It also features Leo Fender's patented tremolo system, a combination vibrato unit, bridge, and tailpiece.

In the hands of Buddy Holly and others, the Fender Stratocaster became an American icon, like the Harley-Davidson motorcycle. This is only fair, for most innovations of any importance involving the electric guitar have taken place in America (which may explain, at least in part, why rock 'n' roll was invented and flourished here). One celebration of the Strat's role in American vernacular culture can be found in Jonathan Richman's 1989 song "Fender Stratocaster": "Like the Dunkin' Donuts in Mattapan / Like the Thrifty Drugs in Santa An' . . . Fender Stratocaster, well there's something about that sound." A few years later Die Goldenen Zitronen (The Golden Lemons), a German punk band, paid homage to Richman's composition

with a song of their own, also called "Fender Stratocaster." Such cross-cultural borrowing, which is virtually as old as rock itself, shows how the electric guitar has permeated the international music scene, making it one of America's most successful cultural exports.

Fender and Gibson weren't the only companies making solid-body electric guitars, but they were the pioneers, and their instruments are among the most sought after on the vintage market. Major competitors included Rickenbacker and

Gretsch, although the latter is better known for its hollow-body electrics, which came to be appreciated for their tonal qualities after engineers learned to control the feedback problems. In 1964 Rickenbacker introduced its 360-12 model, the first commercially significant 12-string electric guitar, which was popularized by George Harrison in the Beatles' 1964 movie *A Hard Day's Night*. When Jim (later Roger) McGuinn saw the movie, he went right out and bought himself a 12-string Rickenbacker, which would soon give McGuinn's group, the Byrds, its instantly recognizable jangling sound.

Because the sonic character of a solid-body electric does not depend on its shape, makers could experiment with a wide range of imaginative designs. The Stratocaster,

modernistic and space-age yet still recognizably guitar-shaped, remains a classic of 1950s design. The Gibson Flying V was the firm's first boldly shaped electric guitar. It was introduced in 1958 as part of a modernistic line of guitars, along with the angular, asymmetrical Explorer. These designs proved too extreme for the market and were soon discontinued. In the late 1960s, however, musicians like Albert King and Jimi Hendrix (who was recently named the greatest guitarist of all time by *Rolling Stone*) helped revive the Flying V's popularity, encouraging guitar makers to develop other adventurous shapes.

While the electric guitar was feeding rock 'n' roll's explosive growth, what about the genre of music that had started it all? In jazz the guitar lost its role as a rhythm instrument with the demise of the big bands in the 1950s. As a solo instrument, the electric guitar is still struggling to free itself from its associations with fusion (jazz for rock fans) and smooth jazz (jazz for office workers). Those genres do have their adherents, of course. And with such virtuosos as George Benson and Pat Metheny, jazz guitar is still alive and doing about as well



The blues master Albert King plays a Gibson Flying V at the Montreux Jazz Festival, in Switzerland, July 1, 1973.

AT FIRST THE ELECTRIC GUITAR JUST WANTED TO BE HEARD, BUT IT ENDED UP TAKING OVER POPULAR MUSIC AND REVOLUTIONIZING SOCIETY.

as anything else in jazz. Yet if there had been no electric guitar, jazz today would sound pretty much the same, whereas rock 'n' roll would not exist at all.

As for blues, the electric guitar revitalized the genre, as its versatility gave musicians fresh ways to express emotion. Beginning in the 1940s, a new, urban-edged style of blues, born in Chicago, was built entirely on amplified sound. Bluesmen like Muddy Waters and the Texan great T-Bone Walker (who has been called the Father of Electric Blues) also took up the amplified guitar and, along with Charlie Christian, inspired a new generation of performers, led by the likes of B. B. King.

During the 1950s blues-based music that had strayed too far from its roots became known as "rhythm and blues," a term that was as nebulous then as it remains today. Eventually, of course, in the words of Muddy Waters, "The blues had a baby, and they named the baby rock and roll." Early rockers clung to the notion that the baby was destined to take after its father, so they idolized and often imitated the great bluesmen. The blues remained an obsession for most rockers into the 1970s, and when the talent scout Danny Fields first heard the Ramones at CBGB's in 1974, he was ecstatic at finally finding music that was "all rock and no blues"—chiefly because, like most punk bands, the Ramones were nowhere near good enough to play blues convincingly.

The most powerful demonstration of the electric guitar's role as a sociopolitical symbol came at the 1965 Newport Folk Festival, when Bob Dylan, a tireless innovator in folk and blues idioms and a protest singer of solidly liberal values, plugged

in an electric guitar amid boos and catcalls from the audience. On one level, it was a betrayal; the young genius who could have led a new generation of fans to the timeless joys of American folk music was instead (as the folkies saw it) pandering to the tastes of teenyboppers. More than that, however, Dylan's act of plugging in symbolized the merger of the political left with the counterculture. The divergent paths Dylan's music was taking were not what alienated fans; it was the electric guitar. Dylan could get as experimental as he wanted, and everything would have been fine as long as he didn't plug in.

What gives the electric guitar such potency? For all the basic and straightforward nature of much rock music, the electric guitar's most important quality may be its versatility. Once guitarists got accustomed to changing the sound by using tone and volume knobs and the tremolo bar, they began to look further. In the early 1960s artificial reverberation created the distinctive "surf-style" instrumental sound of the Ventures and, in Britain, the Shadows. Producers learned that feedback and interference could be their friends, developing circuits and devices that allowed fuzz, delay, wah-wah, compression, and a host of other embellishments to be invoked on demand.

The most influential master of manipulated sound in the 1960s was Jimi Hendrix, whose influence remains strong after nearly four decades. With techniques such as maneuvering the guitar's tremolo arm and playing close to the amplifier, not to mention setting the guitar on fire, Hendrix achieved spectacular effects: "Sometimes I jump on the guitar. Sometimes I grind the strings against the frets. The more it grinds, the more it whines. Sometimes I rub my teeth, or with my elbow. I can't remember all the things I do."

Through the 1970s and 1980s rock guitarists continued experimenting. One genre emphasized raucous power chords, flashy solos, and overall loud volume. It came to be known as "heavy metal." Eddie Van Halen, of the band Van Halen, experimented with stunts like dive-bombing, using the tremolo arm to drive the guitar's lowest note even lower. Hendrix had done this, but he usually forced the guitar out of tune as a result. However, by the mid-1980s the inventor Floyd Rose had improved solid-body guitar tremolo systems, making it possible to dive-bomb repeatedly.

Guitarists increasingly regarded their instruments as identifying signatures and had makers customize them. Eddie Van Halen decorated his with colored sticky tape, while Prince had guitars of all shapes and sizes created for his stage performances. The country musician Junior Brown took the customization of his guitar a step further. To solve the problem of switching back and forth between a Spanish-style electric and a lap-steel electric, Brown put the two together to form a hybrid "guit-steel."

Junior Brown plays his hybrid "guit-steel," August 2003.





In the mid-1980s the collection of Marco Pirroni of Adam and the Ants included (center) a custom model originally built for Dave Hill of Slade.

In keeping with its status as a symbol of America, the electric guitar is the most democratic of instruments. It is extremely accessible in terms of both cost and learning curves. A beginner can manage a few chords after a lesson or two, and sometimes that's all you need. And while electric-guitar players are still overwhelmingly male, women are increasingly making their mark. Once the very act of playing an electric guitar seemed inherently aggressive and masculine, but since the 1970s female guitarists like Bonnie Raitt and Joan Jett have become prominent. Raitt got her start playing blues, and her musical style continues to evolve, combining elements of blues, pop, and rock. Jett and her band the Blackhearts made a splash in the 1980s with their harder edge. Jett's influence on the music scene earned her a place on *Rolling Stone's* top 100 list,

one of only two women included (the other was Joni Mitchell).

The electric guitar is a prime example of the law of unintended consequences. At first it just wanted to be heard, but it ended up taking over popular music and revolutionizing society along the way. Amplified musical technology is now at the forefront, and since most of the music we hear is electrified and synthesized, performing "unplugged" has become the exception rather than the rule. Today, more than seven decades after bursting onto the scene, the electric guitar is played and enjoyed worldwide and has achieved iconic status as a symbol of American culture. ★

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