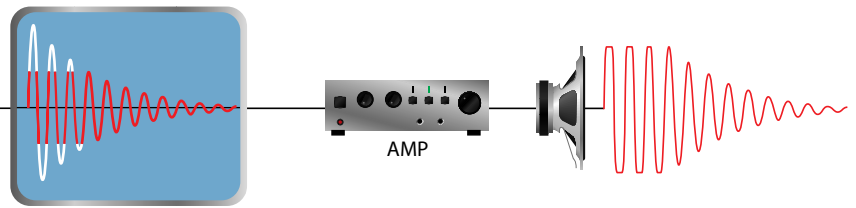
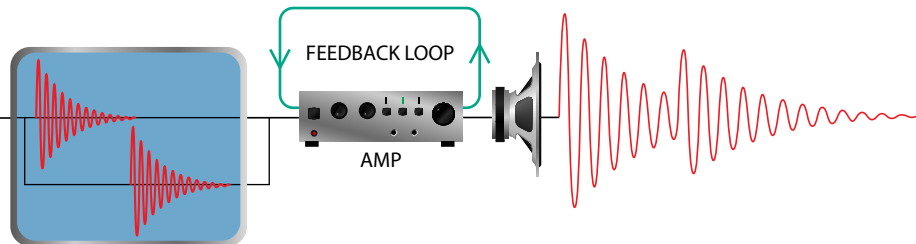


WORKING KNOWLEDGE

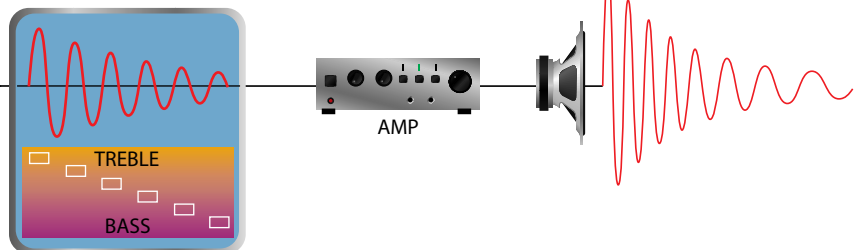
GUITAR-EFFECTS PEDALS



BIG MUFF produces a guitar note of relatively constant amplitude, drawing out the sound until it eventually decays. It does so by clipping off the high and low peaks. The effect resembles one that the musician Jimi Hendrix (*left*) produced by vibrating his finger on the guitar fret to delay the note from dying out.

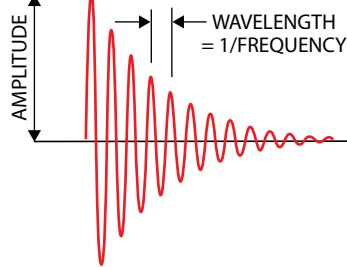


DELAY EFFECTS store information about the frequency and amplitude of a plucked guitar note. The device then resends the same note to an amplifier a few milliseconds after the string is first plucked, producing a reverberation similar to that heard in a large concert hall. The delay can also be cycled back to the amplifier through a feedback loop to create an even more distinct echo effect. The delay sound is often used in rockabilly music.



"WAH-WAH" sound is produced electronically with a filtering device that selects a series of tones, which are the frequencies that make up a note. The blue box representing the filter shows that at a given amplitude (*sine waves on top*), the device excludes all but a few tones (*descending boxes at bottom*). Consequently, the output note shifts from high- to low-frequency tones as the amplitude diminishes: clear, bright treble sounds gradually become muffled bass tones, evoking the familiar "wah" sound. The effect is similar to one produced by mechanically pumping a "wah-wah" pedal with the foot. It has been used by funk rock groups such as Parliament-Funkadelic.

MICHAEL GOODMAN (Illustrations); JOEL AXELRAD (Michael Ochs Archives) (photograph)



WAVEFORM of a guitar note is characterized by its volume, or amplitude, represented by the height of the sine wave, and its frequency, the number of oscillations for a given interval of time. The guitar's characteristic waveform can be represented by an initial sharp peak that falls off rapidly.

by Mike Matthews and Robert Myer

The history of rock and roll is one of contorting the resonant note of a plucked guitar string—a tradition that began with the echo and delay sounds that characterized the recordings of Elvis Presley, Gene Vincent, Jerry Lee Lewis and others in the 1950s.

Tape recorders produced the earliest guitar effects. But new ways to alter the sound emerged during the 1960s as circuitry that varied volume (tremolo) or introduced signal delay (reverberation) was built into amplifiers. Perhaps the most dramatic advance came with the advent of the guitar-effects pedal, which is plugged into an amplifier and activated by the tap of a foot.

Effects pedals, marketed with names such as the Big Muff, alter the amplitude,

frequency or phase of a signal to produce sounds ranging from a tinny buzz to a throbbing "wah-wah." Hundreds of effects devices have been invented during the past 35 years. And hundreds more may be forthcoming, because there are virtually an infinite number of ways a note or chord can be modified.

MIKE MATTHEWS and ROBERT MYER worked on the design of many early guitar-effects devices. Matthews is president of Electro Harmonix, a New York City manufacturer of pedals. Myer retired in 1989 as a Distinguished Member of the technical staff at AT&T Bell Laboratories.