How Record Players Produce Sound

A record player is an analog music player composed of four primary parts, the turntable, needle, cartridge and tonearm, that together project the sound pressed into vinyl records. A record is needed to produce sound with a record player. A record is an analog form of music storage where music is pressed onto thin PVC disks in small, tight grooves. Both a record and record player are necessities in order to project audio from the record.

Background

Vinyl Records have seen ups and downs in popularity since the creation of the long play (LP) record in the late 1940s. The creation of the LP was pivotal in the popularity of music that would arise over the 1950s leading into the 1960s. The LP plays at 33 1/3rpm (revolutions per minute) in comparison to its predecessor, the 78rpm record that was common in the decades before. By the 1960s the 78 was a relic of the past as the LP and 45rpm singles enjoyed unprecedented popularity.

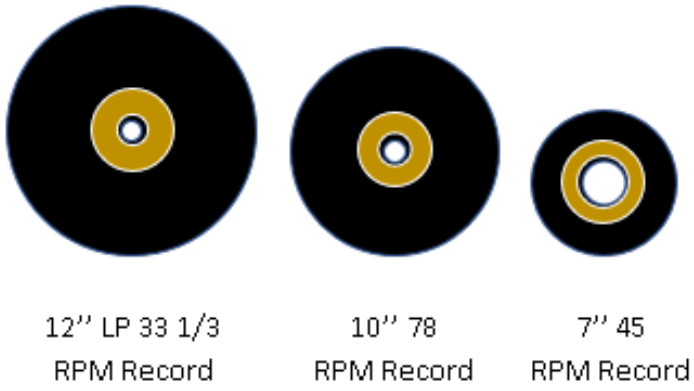

Figure 1: Scaled graphic displaying the proportional size difference between the three most common sizes of records: A 33, 78, and 45.

Components of the Record

Traditional records come in the standard 33 1/3 LP disks. The records are made out of stamped PVC plastic (polyvinyl chloride). The records are stamped with heated metal plates that melt the PVC creating the perfect grooves. Without explaining the full process of how records are made, know that the intricate grooves created when melting and forming the record are what capture the sound that will be projected through the record player.

The physical aspect of records is a significant reason audiophiles gravitate towards records. All portions of the recording that the musician intended to translate to the audience can be captured on the record, where digital formats are more limited.

NOTE: Vinyl records can only hold about 25 minutes of music per side.

Movement Through the Record Player

Every record player has four basic parts: the turntable, needle, cartridge and tonearm. When playing a record, sound travels through the player in this order, eventually projecting out of the record player's speakers. All four components are key to the projection of sound from the record player.

Turntable

The turntable is the most visually recognizable component of any record player. The turntable is the large, motorized spinning table positioned atop the record player. The table spins at the rate set by the user, normally either 33 1/3 or 45 rpm.

NOTE: A broken turntable that is not spinning at the correct speed will distort the audio and could lead to damage of the record or the needle.

Needle

The needle is the component of the record player that reads the music stored on the record. The audio on records is stored in the grooves that are stamped onto the record.

The needle reads both sides of the groove separately, labeled in Figure 2 with their technical names, the left and right channels. Each channel stores the audio and by dragging across each side of the groove, the needle collects the music in the form of vibrations. The vibrations are then transferred to the cartridge.

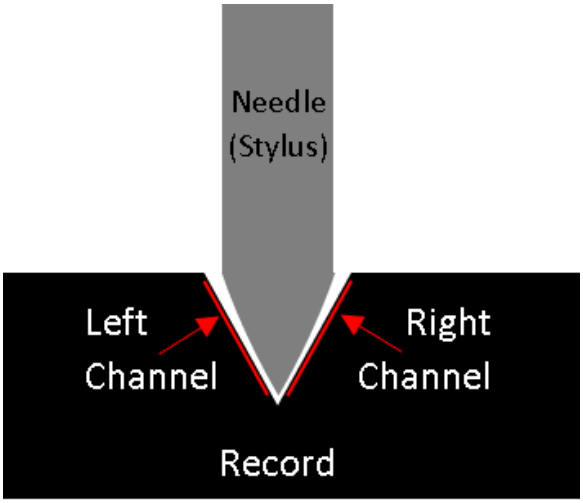

Figure 2: Depiction of the Record Player Needle in the groove of a Record

NOTE: If the turntable is rotating at the incorrect speed for the record, the needle will pick up the distortion in the audio and possibly damage the record.

Cartridge

The process of dragging the needle across the record creates vibrations that are sent to and collected by the cartridge. The cartridge receives the vibrations by taking the needle vibrations up the cantilever to the magnet, as shown in Figure 3. The magnet then receives the vibrations, which pushes the magnet towards either the left or right coil.

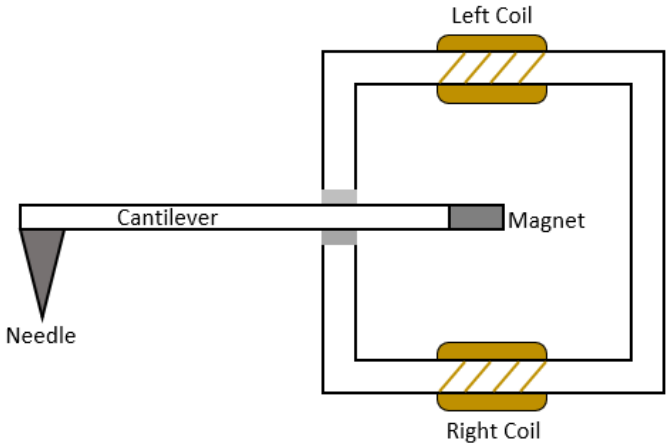

Figure 3: Depiction of what a Record Player Cartridge looks like from the inside

NOTE: Input stored in the right channel of the record is sent to the right coil and information stored on the left channel is sent to the left coil.

When the magnet moves to either coil, a small electric signal is sent through the coil. When playing a record, the process happens rapidly to ensure both channels are receiving a steady flow of information from the incoming vibrations.

Tonearm

Once the vibrations are collected by the cartridge, the vibrations travel up the tonearm of the record player. The tonearm connects the needle and cartridge to the main body of the record player. The tonearm is a pipeline for the electric signals collected in the cartridge, moving the electric signals onto the preamplifier.

NOTE: Within the tonearm, both left and right coil signals are moved together.

After passing through the tonearm, the signal travels to the preamplifier, which strengthens the electric signal (both left and right are still moving through together) and then the signal reaches the actual amplifier which strengthens the signal once more before splitting the left and right channel/coil vibrations to go out of the corresponding speakers. The final, amplified vibrations are what listeners hear as sound.