Selma Ozdemir

Professor Serhiy Metenko

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Technical Description

Description of a record player and how it operates.

Purpose

The purpose of this technical description is to explain the external and internal components of a record player for musicians or individuals interested in analog audio technology. By breaking down its components and process, this document aims to provide a clear understanding of how record players produce sound from vinyl.

Introduction

The record player has been a staple in audio playback since its invention in the late 19th century. It uses a combination of mechanical and electrical components to convert the grooves into an amplified audio signal. The record player is similar in function and design to a phonograph. The first device of its kind was Thomas Edison's phonograph, invented in 1877. Phonograph is a device that records sound by etching grooves into a tinfoil cylinder, which is played back by tracing the grooves with a needle. Similar to phonograph, vinyl records capture sound by converting the electrical waveform of the music into an analog waveform vibrating the needle. The electrical signal transmits information about the music, including its wavelengths, frequency, and speed. With the rise of digital technology, music storage largely transitioned to digital formats. However, vinyl records are still popular because of their rich and warm analog sound. Record players continue to provide an authentic listening experience that resonates with music lovers today.

External Components

The main external components of a record player include the case, handle, turntable, amplifier, and speakers.

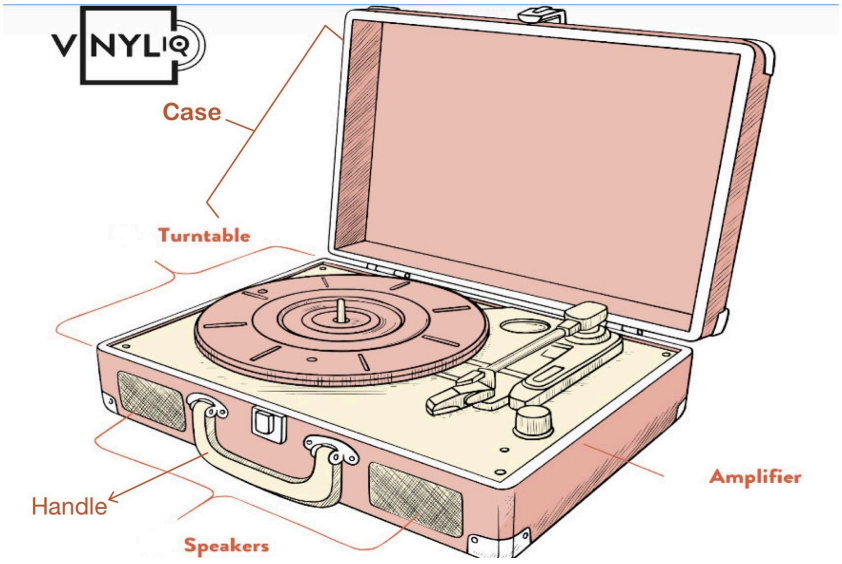

Figure 1: Record Player Parts. Image Courtesy from Vinyliq.

Case: The outer part of a record player that provides structural support. The case houses and protects the internal components.

Handle: The handle enables convenient and effortless transport. This feature can be found in suitcase style record players.

Turntable**:** The term "turntable" refers to the primary component of a record player that rotates the vinyl record and reads the information from its surface. Turntables generally output an audio signal at phono level, this is quite weak and not strong enough to transform to a regular amplifier. This signal requires additional amplification to reach ***line level*** in order to work properly with speakers.

Amplifier: Record players require an internal ***preamplifier*** to boost the weak electrical signal produced by the needle to a level that can be heard through speakers.

Speakers: Almost all of the all-in-one record players come with built-in speakers, but some use external ones. These speakers are usually powered speakers, meaning they require amplification to increase the audio signal to an appropriate level for playback.

Internal Components

The internal components of a record player includes components such as the plinth, platter, tonearm, motor, and anti-skate. Together with the cartridge, stylus and coil that work together to produce sound.

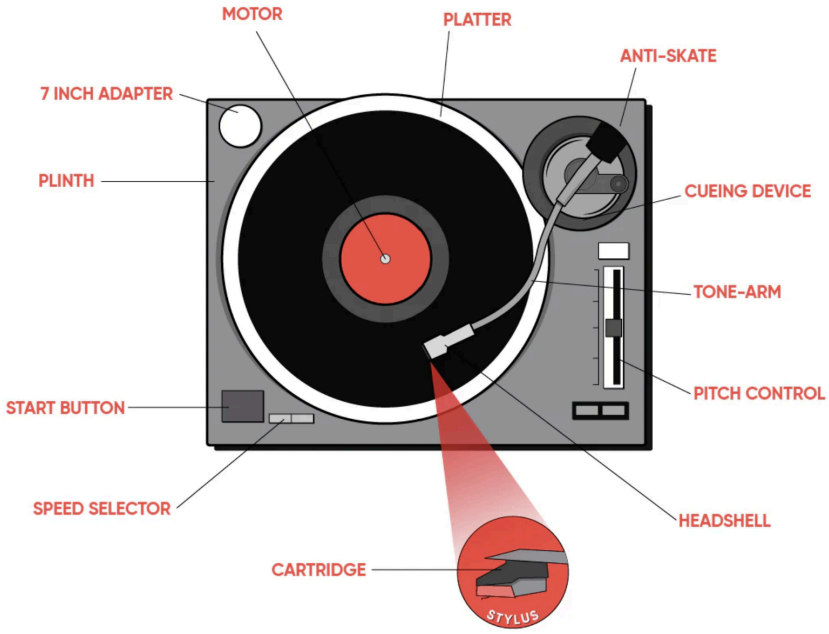

Figure 2: Anatomy of a Turntable. Image Courtesy of the Volver Club.

Plinth (Base): The base of the record player that houses the components.

Platter: The rotating platform where the vinyl record sits. It is the central part of the turntable system and rotates in a clockwise direction.

Tone-Arm: It retains the cartridge while enabling the stylus to glide across the record's grooves. It is an essential connection between the speakers and the record.

Speed Selector: Allows users to adjust the platter's rotation speed according to the type of record. Alters the platter's speed from 33 RPM to 45 RPM.

Motor: The component responsible for spinning the platter at a consistent speed. Turntables typically use either ***direct drive*** or ***belt drive***.

The motor drives the spindle,

> Spindle: The small metal rod at the center of the turntable platter that holds the record in place as it spins. It is directly driven by the motor to rotate the record at a constant speed.

Start Button: Powers the turntable motor.

Headshell: The detachable part of the tonearm that holds the cartridge and stylus.

Pitch Control: It modifies the voltage applied to the motor to change the platter's speed. Allows the user to adjust the speed.

Cueing Device: The stylus is raised and lowered from the record. It can be either manual or automatic.

Anti-Skate: A mechanism that prevents the tonearm from pulling too much toward the center of the record.

Cartridge: Holds the stylus. Converts the mechanical vibrations from the stylus into an electrical signal.

The cartridge contains several key components that work together to complete this conversion progress, including:

> Cantilever: The small, thin rod connected to the stylus. It transmits the vibrations from the stylus to the cartridge, where they are converted into an electrical signal.
>
> Stylus (Needle): A small, pointed component that tracks the grooves of the record and picks up vibrations.
>
> Coil: They are the components of a magnetic system located inside the cartridge. The magnet inside the cartridge moves in relation to the coils as the stylus vibrates in the record's grooves.
>
> Suspension: The system of components that helps absorb vibrations and maintain stability in the turntable's parts. The suspension ensures that unwanted vibrations from the motor or external sources don't interfere with the tracking of the stylus in the grooves of the record.
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> Magnet: Crucial element in the process of converting mechanical vibrations into electrical signals.

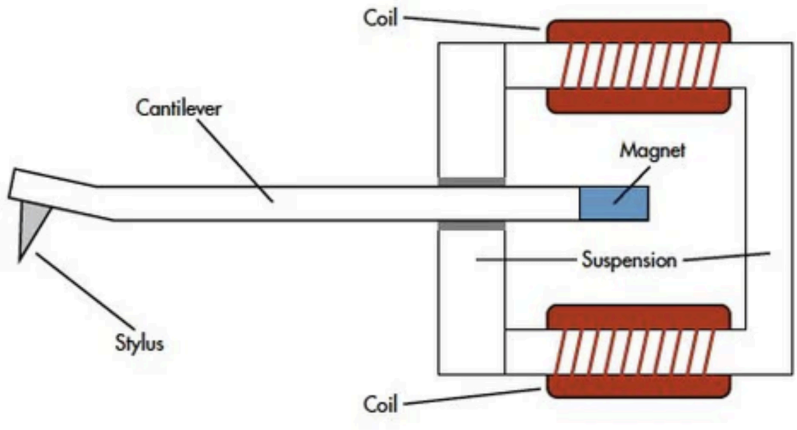

Figure 3: Turntable Cartridge. Image Courtesy of the Volver Club.

How does it work?

A record player begins operation when the user places the needle on the spinning vinyl, converting the grooves on a vinyl record into sound through mechanical and electrical processes. The turntable and platter spin the record at a steady speed, while the stylus (needle) traces the grooves, causing vibrations. These vibrations are transmitted to the cartridge, where a magnet moves within coils, generating an electrical signal based on Faraday's Law of Electromagnetic Induction.

This weak signal is boosted by a pre-amplifier, which also applies an equalization curve to restore the original sound balance. A power amplifier further strengthens the signal before it reaches the speakers, which convert it into sound. This process gives vinyl records their distinctive warm and rich audio quality.

Conclusion

A record player is a precisely crafted device that blends mechanical and electrical processes to produce sound from vinyl records. The intricate components of a record player, from the stylus that tracks the grooves to the amplification mechanism, work harmoniously. Beyond its technical functions, the current use of the record player shows a strong appreciation for the physical experience of music, the nostalgia of analog sound, and the desire for high-quality audio. Record players continue to attract listeners to this day. Perhaps because of the mystery of dropping a needle on vinyl creates a unique sense of wonder unmatched compared to pressing "play" on a streaming service. As technology evolves, the record player stands as a timeless piece of audio history, continuing to bridge the past and present through the enduring appeal of analog sound.

Glossary

Belt Drive: The motor is connected via a belt for reduced vibrations, preferred for audiophile setups.

Direct Drive: The motor is directly connected to the platter, often used by DJs.

Line level: Line level is the audio signal that passes through your recording equipment before it is sent to the speakers for playback.

Preamplifier: an amplifier built to boost very weak electrical signals before sending them to other circuits for amplifiers.

Preamp: An amplifier that strengthens the electrical signal from the cartridge.

RPM (Revolutions Per Minute): The speed at which a record spins.

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