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Technical Description

Description of a record player and how it operates.

Abstract: A record player, also known as a turntable, is a device used to play vinyl records by converting analog sound waves etched into a vinyl disc into audible sound. This document explains the components and operational process of a record player, detailing both its internal and external parts and how they function together to produce sound.

How does a record player work?

Purpose: The purpose of this technical description is to explain the mechanical and electrical workings of a record player in a way that is accessible to individuals interested in analog audio technology. By breaking down its components and process, this document provides an understanding of how vinyl records produce sound.

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 in a vinyl record into an amplified audio signal. Thomas Edison's phonograph (1877) recorded sound by etching grooves into a tinfoil cylinder, which was then played back by tracing the grooves with a needle. Emile Berliner enhanced this idea in the 1880s with the invention of the phonograph, which revolutionized home music consumption by using flat discs rather than cylinders to enable mass production of records.

With the rise of digital technology, music storage largely transitioned to digital formats. However, vinyl records remain popular for their rich, warm analog sound. Record players continue to thrive, offering an authentic listening experience that appeals to enthusiasts today.

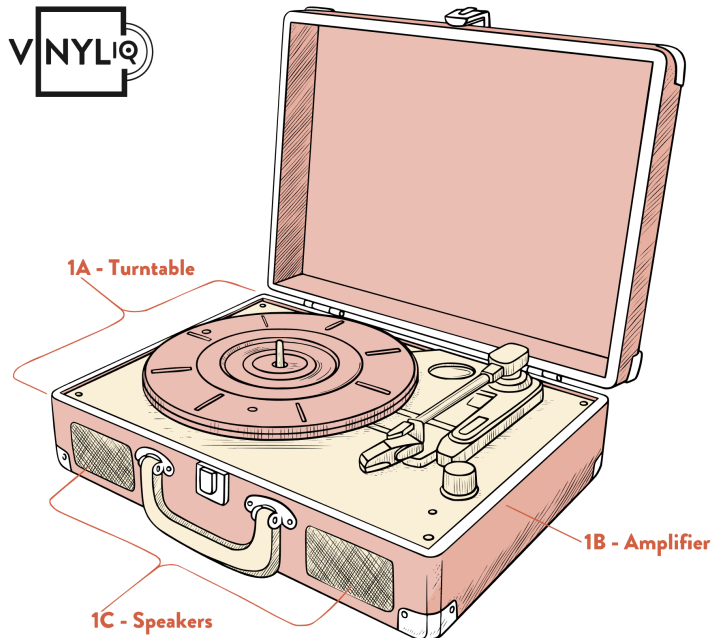


Figure 1: Record Player Parts. Image Courtesy from Vinyliq.

1. **Turntable:** The term "turntable" refers to the primary component of a record player responsible for rotating the vinyl record and reading the information from its surface. Turntables generally output an audio signal at phono level, which is quite weak and not strong enough to directly feed into a regular amplifier. This signal requires additional amplification to reach *line level* in order to work properly with speakers.
2. **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.
3. **Speakers:** Most all-in-one turntables come with built-in speakers, although 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.

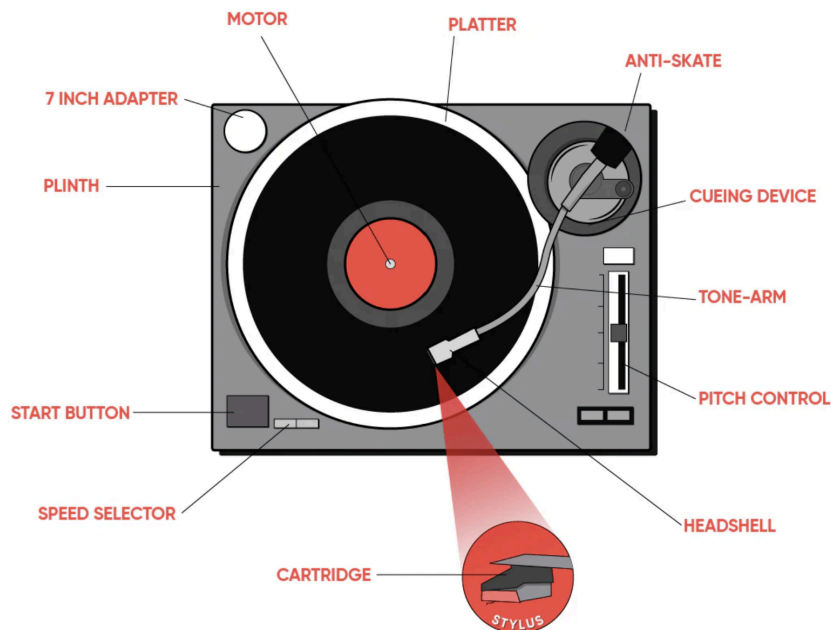


Figure 2: Anatomy of a Turntable. Image Courtesy of the Volver Club.

Components:

1. **Plinth (Base):** The base of the record player that houses all components.
2. **Turntable (Platter):** The rotating platform where the vinyl record sits. It is the central part of the turntable system and rotates in a clockwise direction.
3. **Tonearm:** 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.
4. **Stylus (Needle):** A small, pointed component that tracks the grooves of the record and picks up vibrations.
5. **Cartridge:** Converts the mechanical vibrations from the stylus into an electrical signal.
6. **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.
7. **Motor:** The component responsible for spinning the platter at a consistent speed. Turntables typically use either *direct drive* or *belt drive*.
8. **Start Button:** Powers the turntable motor.
9. **Headshell:** The detachable part of the tonearm that holds the cartridge and stylus.
10. **Pitch Control:** It modifies the voltage applied to the motor to change the platter's speed. Allows the user to adjust the speed.

11. **Cueing Device:** The stylus is raised and lowered from the record. It can be either manual or automatic.
12. **Anti-Skate:** A mechanism that prevents the tonearm from pulling too much toward the center of the record.
13. **7-inch Adapter:** It is used for playing 7-inch vinyl records (commonly 45 *RPM*) that have a larger center hole. A small circular or donut-shaped adapter that fits over the spindle of the turntable.
14. **Spindle:** The small metal rod at the center of the turntable platter that holds the record in place as it spins. Located in the Motor part.

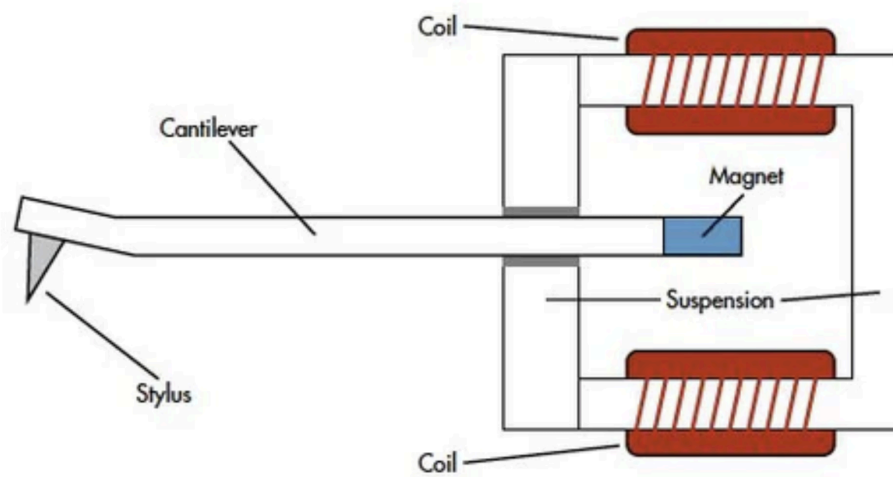


Figure 3: Turntable Cartridge. Image Courtesy of the Volver Club.

1. **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.
2. **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.
3. **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.
4. **Magnet:** Crucial element in the process of converting mechanical vibrations into electrical signals.

The stylus, a cone-shaped part composed of diamond, the hardest natural substance on Earth, is positioned at one end of the cantilever.

Vibrations along the vinyl record's groove are detected by the stylus. These identical vibrations reach the cartridge at the end of the tonearm after passing through the metal band at the cantilever's end.

The cartridge houses coils within a magnetic field, and when vibrations reach these coils, they generate electrical signals.

These signals are then amplified and transmitted through the speakers.

How does it work?

A record player converts 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.

Process:

1. **Placing the Record:** The user places a vinyl record on the turntable.
2. **Starting the Rotation:** The turntable motor spins the platter at the selected speed.
3. **Engaging the Stylus:** The user lowers the tonearm, allowing the stylus to make contact with the record grooves.
4. **Tracking the Grooves:** The stylus follows the grooves, causing it to vibrate in response to the record's physical patterns.
5. **Signal Conversion:** The cartridge converts these mechanical vibrations into an electrical signal.
6. **Amplification and Playback:** The signal is sent to a *preamp* and then to speakers, producing sound.

Conclusion: A record player is a sophisticated yet elegantly designed device that seamlessly 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 to preserve the authenticity

of analog sound. Beyond its technical functions, the use of vinyl shows a strong appreciation for the physical experience of music, the nostalgia of analog sound, and the desire for high-quality audio. Record players are a testament to early audio engineering, providing a rich and immersive listening experience that continues to attract listeners. 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:

- **Preamp:** An amplifier that strengthens the electrical signal from the cartridge.
- **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.
- **RPM (Revolutions Per Minute):** The speed at which a record spins.
- **Direct Drive:** The motor is directly connected to the platter, often used by DJs.
- **Belt Drive:** The motor is connected via a belt for reduced vibrations, preferred for audiophile setups.

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