Read out from the Disc

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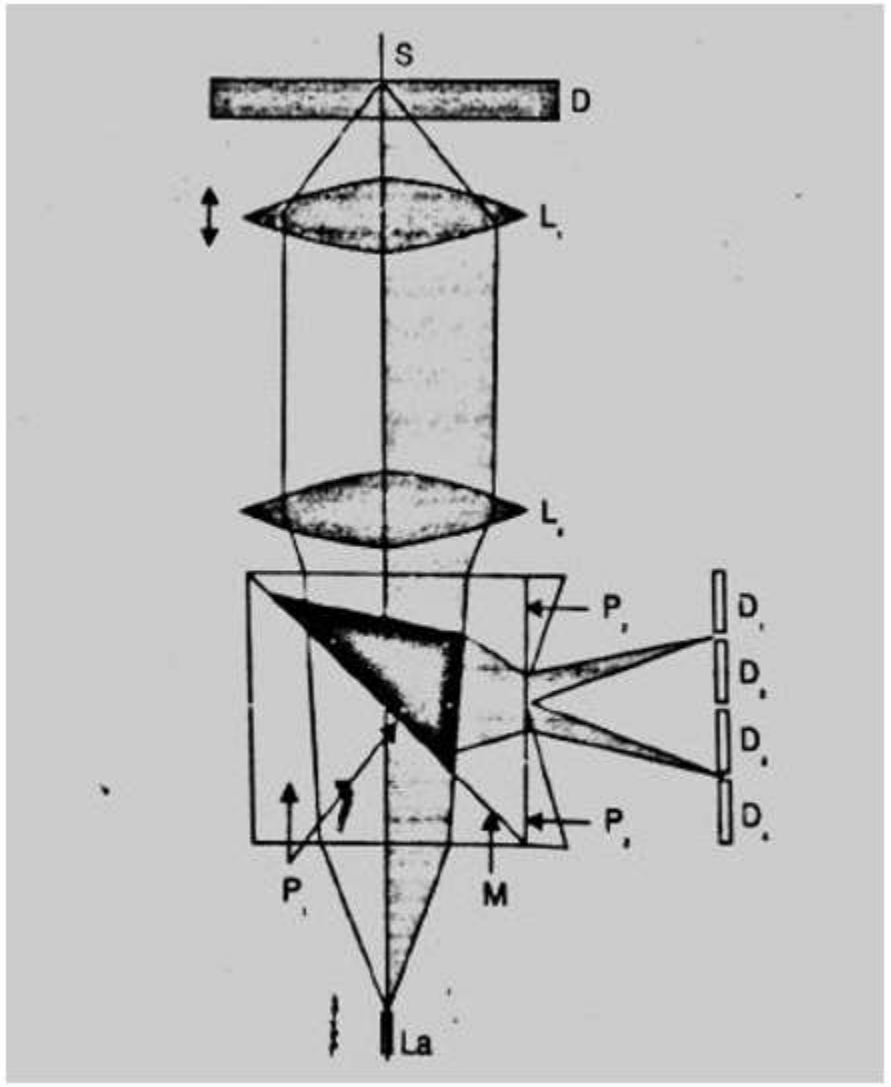
- The disc is optically scanned in the player. This is done by AlGaAs semiconductor laser.
- The light from the laser La (wavelength 800 nm) is focused through the lenses L2 and L1onto the reflecting layer of the disc.
- The diameter of the light spot S, is about 1 µm.
- When the spot lands on a pit— the depth of a pit is about ¼ of the wavelength in the transparent substrate material— interference causes less light to be reflected and an appreciably smaller amount reaches the photodiodes.

- When the output signals from the four photodiodes are added together the result is a fairly rough approximation to the rectangular pulse pattern present on the disc in the form of pits and intervals.
- The optical pick-up shown is very small (about 45 * 12 mm) and is mounted in a pivoting arm that enables the pick-up to describe a radial arc across the disc, so that it can scan the complete spiral track.
- Around the pivotal point of arm is mounted a linear motor that consists of a combination of a coil and permanent magnet.
- When the coil is energised the pick-up can be directed to any required part of the track, finite locational information being provided by the C & D bits added to each frame on the disc.

- The pick-up is this able to find independently any particular passage of music indicated by the listener.
- When it has been found the pick-up must then follow the track accurately to within ±0.1 µm without being affected by the next previous track.
- Since the track on the disc may have some slight eccentricity, and since also the suspension of the turntable is not perfect, the track may have a maximum side-to-side swing of 300 µm.
- A tracking servo system is therefore necessary to ensure that the deviation between pick-up and track is smaller than the permitted value of + 0.1 pm and in addition, to absorb the consequences of small vibrations of the player.

- The tracking-error signal is delivered by the four photodiodes D. to D4. When the spot S, seen in the radial direction, is situated in the centre of the track, a symmetrical beam is reflected.
- If the spot lies slightly to one side of the track, however, interference effects cause asymmetry in the reflected beam.
- This asymmetry is detected by the prism Pr which splits the beam into two components.
- Beyond the prism, one component has a higher mean intensity than the other. The signal obtained by coupling the photodiodes as (D, + D2) - (D3 + D4) can therefore be used as a tracking error signal.
- As a result of the aging or soiling of the optical system, the reflected beam may acquire a slowly increasing, more or less constant asymmetry.
- Owing to a dc component in the tracking error signal, the spot will be slightly off-centre of the track. To compensate for this effect a second tracking error signal is generated.

Diagram of the optical pick-up



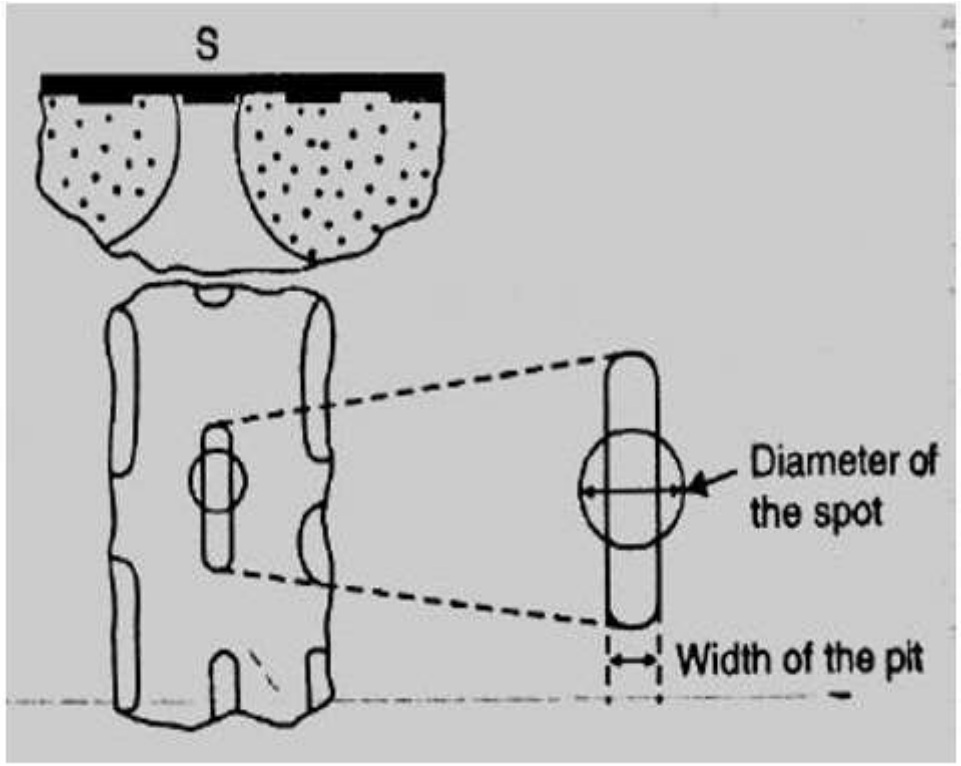
- The coil that controls the pickup arm is therefore supplied with an alternating voltage at 600 Hz, with amplitude that corresponds to a radial displacement of the spot by +0.05 µm.

- The output sum signal from the four photodiodes which is at a maximum when the spot is at the centre of the track is thus modulated by an alternating voltage of 600 Hz.

- The amplitude of this 600 Hz signal increases as the spot moves off-centre. In addition the sign of the 600 Hz error signal changes if the spot moves to the other side of the track.

- This second tracking-error signal is therefore used to correct the error signal mentioned earlier with a direct voltage. The output sum signal from the photodiodes, which is T processed in the player to become the audio signal, is thus returned to its maximum value.

A magnified view of the light spot Sand its immediate surroundings, with a plan view.



- The depth of focus of the optical pick-up at the position S (see Fig. 14.4) is about 4 pm. The axial deviation of the disc, owing to various mechanical effects, can be maximum of 1 mm.
- It is evident that are servo system is also necessary to give correct focusing of the pick-up on the reflecting layer. The objective lens L1, can therefore be displaced in the direction of its optical axis by a combination of a coil and a permanent magnet, in the same way as in a loudspeaker.
- The focusing-error signal is also provided 40 by the row of photodiodes D1 to D4.
- If the spot is sharply focused on the disc, two sharp images are precisely located between D1 and D2 and between D3 and D4.
- If the spot is not sharply focused on the disc, the two images on the photodiodes are not sharp either and have also moved closer together or further apart.
- The signal obtained by connecting the photodiodes as (D1 +D4) - (D2 + D3) can therefore be used for controlling the focusing servo system. The