

PHY_366 (A) - TECHNICAL ELECTRONICS- II
UNIT 2 – PUBLIC ADDRESS SYSTEM

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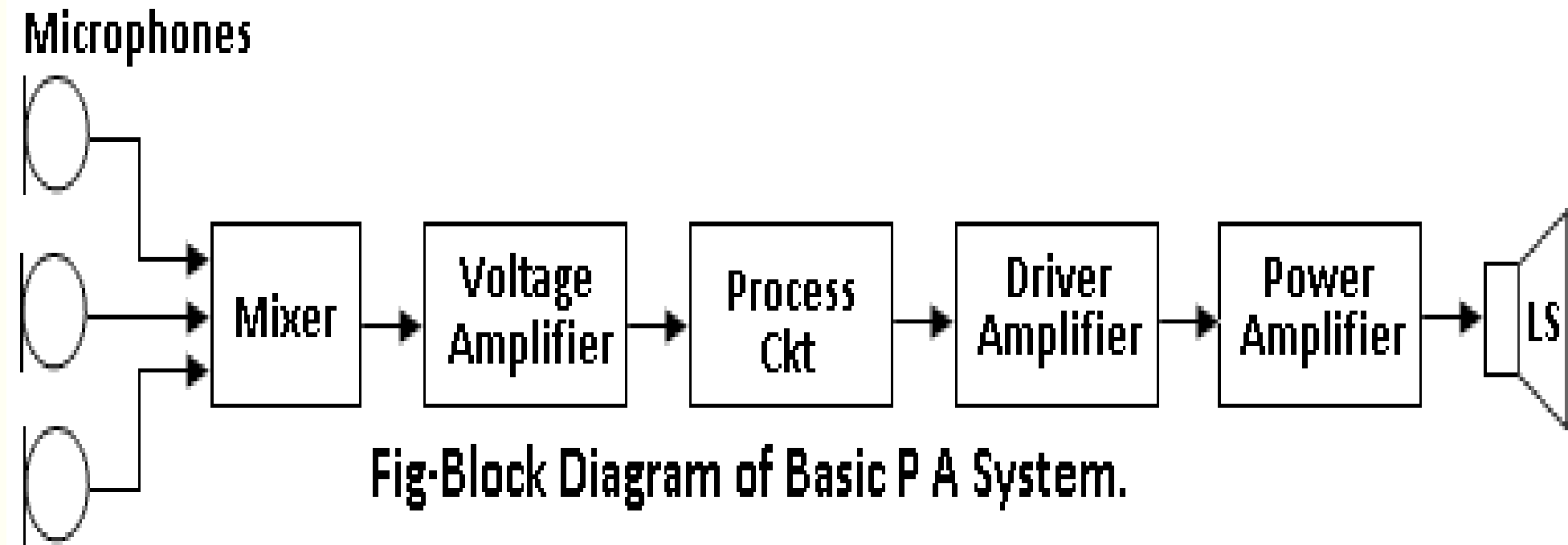
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Contents:

- **Block diagram of P.A. system and its explanation, requirements of P A system, typical P.A.**
- **Installation planning (Auditorium having large capacity, college sports), Volume control, Tone control and Mixer system,**
- **Concept of Hi-Fi system, Monophony, Stereophony, Quadraphony, Dolby-A and Dolby-B system,**
- **CD- Player: Block diagram of CD player and function of each block.**

Block diagram of P.A. system:



Basic Requirements of PA System:

- **Acoustic feed back:** The sound from the loudspeakers should not reach microphone. It may result in loud howling sound.
- **Distribution of Sound Intensity:** Instead of installing one or two powerful loudspeakers near the stage alone, audio power should be divided between several loudspeakers to spread it right up to the farthest point. This covers every specified area.
- **Reverberation (Echo):** Install several small power loudspeakers at various points to get rid of problem of overlapping of sound waves in the auditorium, rather than using single power high power unit.

Basic Requirements of PA System:

- **Orientation of speakers:** The loudspeakers be oriented as to direct the sound towards the audience and not towards walls. The loudspeakers should preferably be placed a meter off the floor, so that their axes are about the height of the ears of the listeners.
- **Selection of Microphone:** Microphone for PA system should be preferably cardioid type, it will prevent reflection of sound from loudspeakers. For dramas use directive microphone.
- **Impedance Matching:** Matching of total loudspeaker impedance with output impedance of amplifier is necessary for maximum transfer of energy from amplifier to loudspeakers.

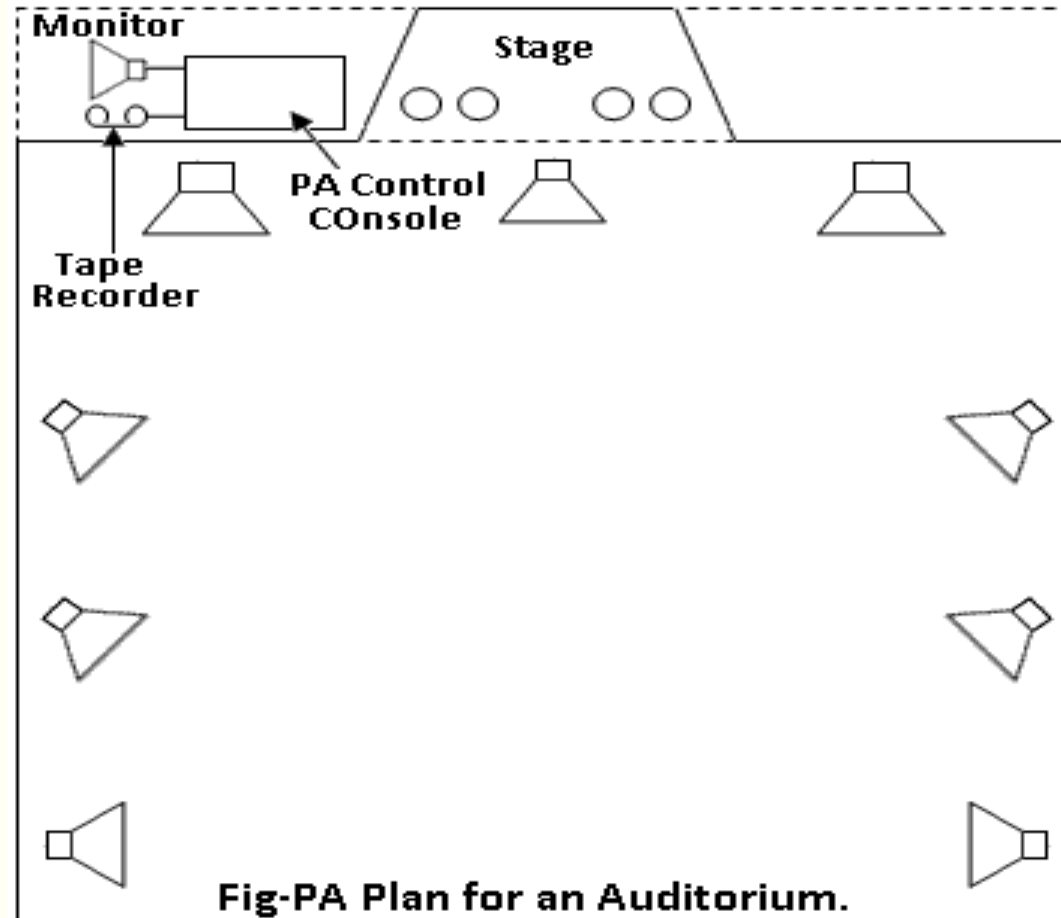
Basic Requirements of PA System:

- **Grounding:** Chassis, shields of equipment's, and coaxial cables should be properly earthed.
- **Ambient Noise:** Use noise cancellation microphones to eliminate ambient noise.
- **Intelligibility:** The loudspeakers should not be located beyond 16 meter apart, 10 meter separation is considered quite good. If they are more than 16 meter apart, the delayed sound from loudspeakers impairs intelligibility, when delay is 45 ms or more

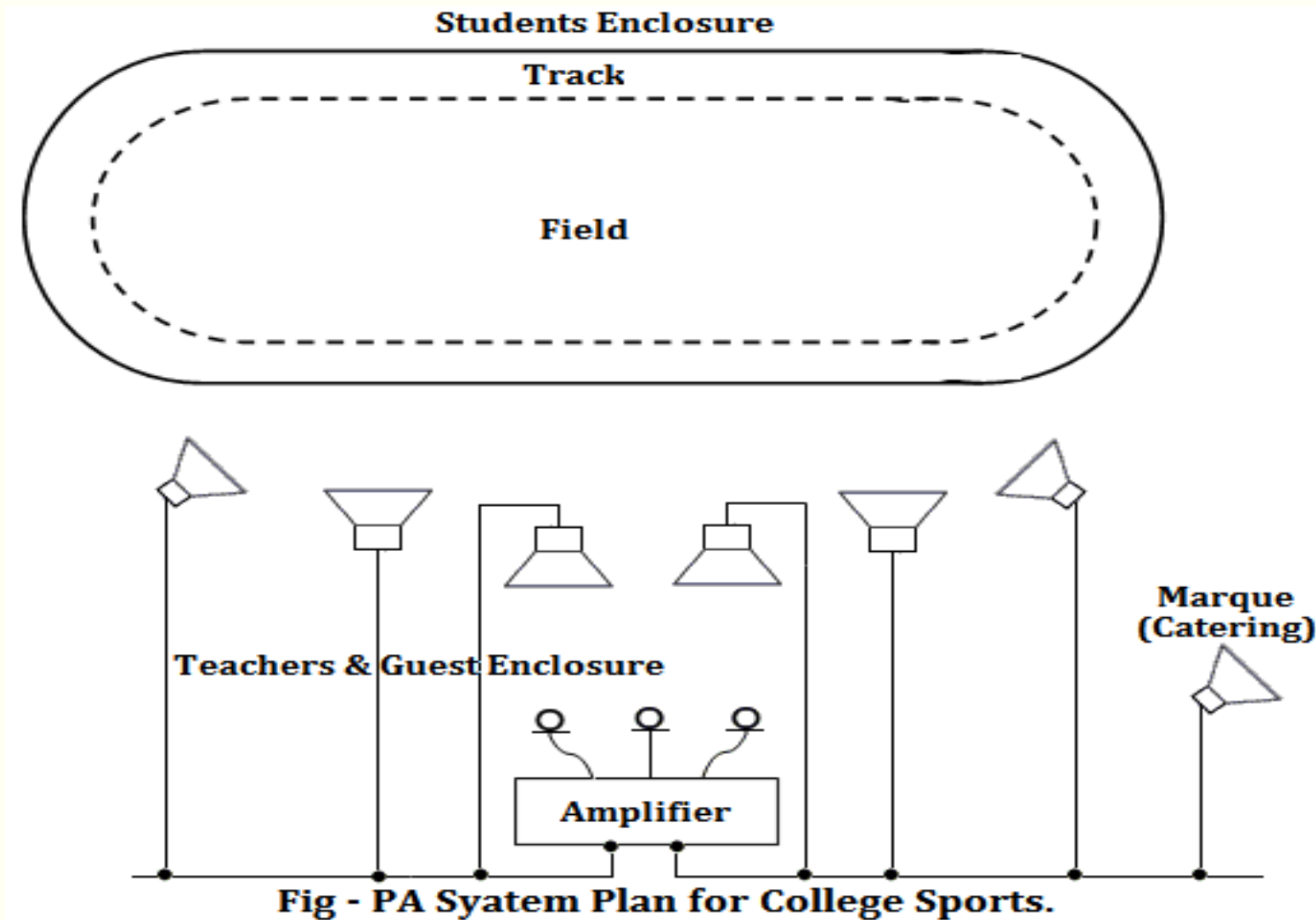
PA system for an Auditorium Having Large Capacity:

- Loudspeaker system, wide range 40-120db (20 – 16 kHz).
- Columns of loudspeakers with good bass & treble response should be mounted facing the front on either side of stage.
- If hall is wide, a small column may also be mounted in the centre of the front line.
- Another pair of small columns, slightly inclined may be placed at about 1/3 then 2/3 down the hall from front.
- A separate mixer unit is desirable, with tape/CD player and at least six microphone inputs. The amplifier should be 50-100W. Standby amplifier is desirable
- For music concert moving coil type should be used. For drama ribbon type microphone should be used.

PA system for an Auditorium Having Large Capacity:



Installation Planning of PA system for College Sports::



Concept of Fidelity:

The word Fidelity means faithfulness, and in sound systems, it is used to indicate faithful reproduction of sound.

The ideal fidelity should have the following characteristics:

- Complete exclusion of noise from sound.
- The signal to noise ratio should be infinite.
- Flat (0 dB) frequency response for complete audio range of 16 Hz to 20 kHz.
- Non-linear distortion should be nil.
- There should be no spatial distortion.
- Environmental conditions should be simulated where the sound is being reproduced.

Concept of Hi-Fi sound:

In audio systems, the term fidelity is used to indicate faithful reproduction of sound.

The reproduction of sound by the sound system is called as Hi-Fi, if it satisfies following conditions (practical conditions);

- **Signal to Noise Ratio should be better than 50dB.**
- **Frequency response should be flat within ± 1 dB, over the frequency range of 40 - 15000 Hz.**
- **Non-linear distortion should not more than 1%.**
- **System should have dynamic range of at least 80 dB.**
- **Stereophonic Effect should be provided.**
- **The external noise in the listening room, and to give the desired reverberation time.**

Monophony:

- The monophony means '**One Sound or One Directional sound or one source Sound**'.
- There is only one amplifier, it combines all the signals and produces one resultant signal.
- The amplifier output may be fed to several loudspeakers and they will give the same resultant sound.
- The human ears will interpret the reproduced sound to be coming from **one source of sound**.

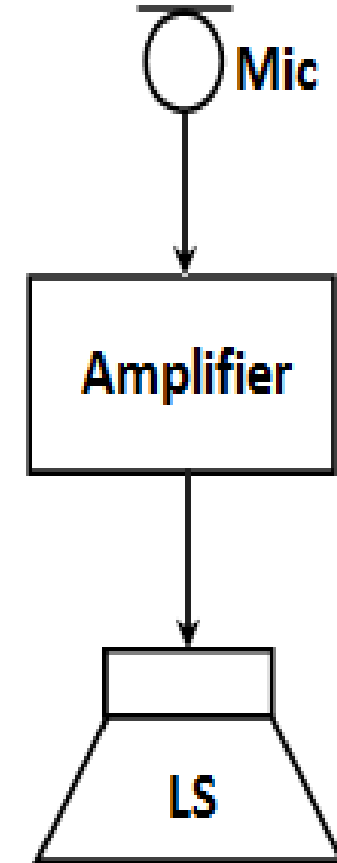


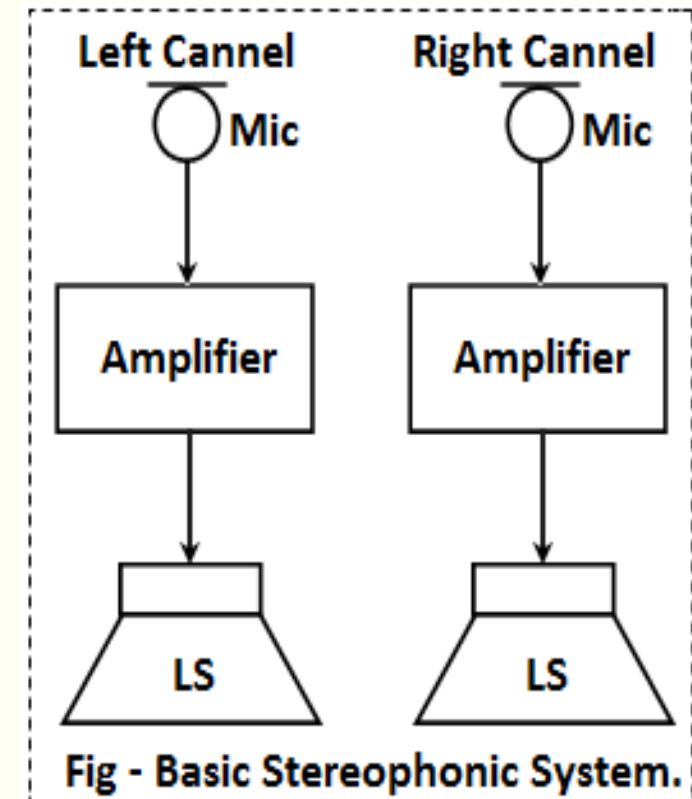
Fig - Monophonic System

Stereophony:

- The word stereophony is derived from two Greek words '**Stereos**' means **Solid** and '**Phone**' means '**Sound**'.
- Stereophony means solid sound or **three- dimensional** sound.
- In a **musical concert or orchestra**, different sources of sound are placed at different positions on the stage.
- If the amplified / reproduced sound appears to come from different directions simulating the original programme.
- This three dimensional sound is called **Stereo**.

Basic Stereophonic System:

- Independent amplifiers have their own set of microphones for input and own set of loudspeakers for output.
- Special recording unit is required, so that the channels may be recorded and reproduced as independent channels.
- In stereo amplifiers, the actual sources of sound are virtually transferred to the respective loudspeakers.
- There are at least two channels, left channel and right channel. Basic stereophonic system is shown in figure.



Ideal Stereo System:

- It is simulation of the human hearing system.
- This can be done by placing two microphones about 25 cm apart on a stand like a pair of ears on head.
- Sound from each microphone is separately recorded and amplified.
- Two microphones are used such that the sound picked by the left microphone goes to the left ear only and right goes to right ear only.

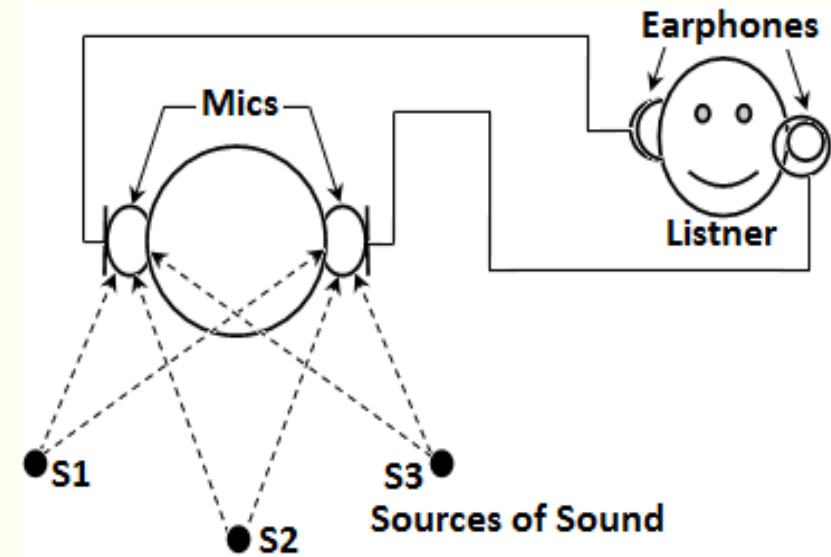
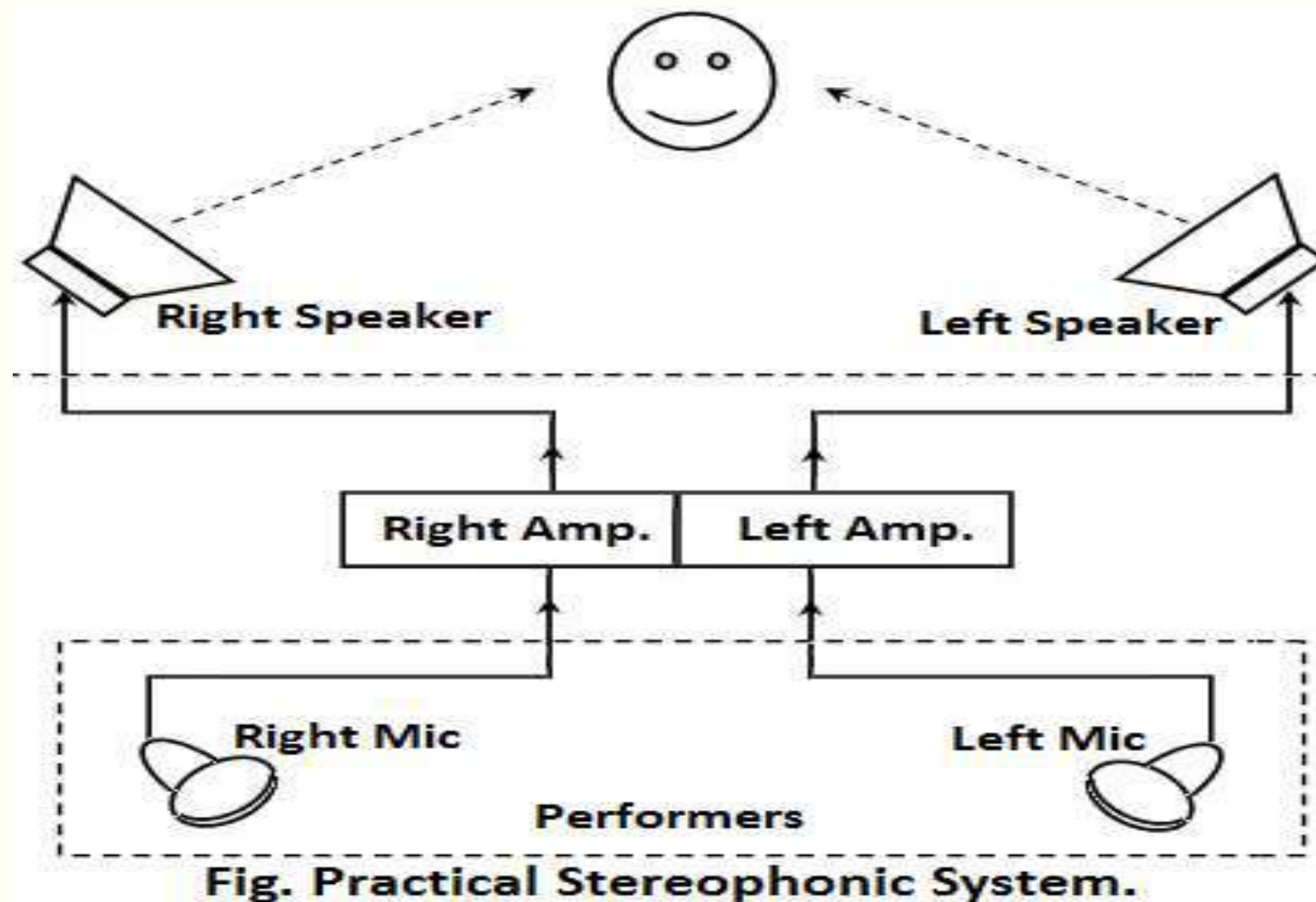


Fig - Ideal Stereo System.

Practical Stereo System:

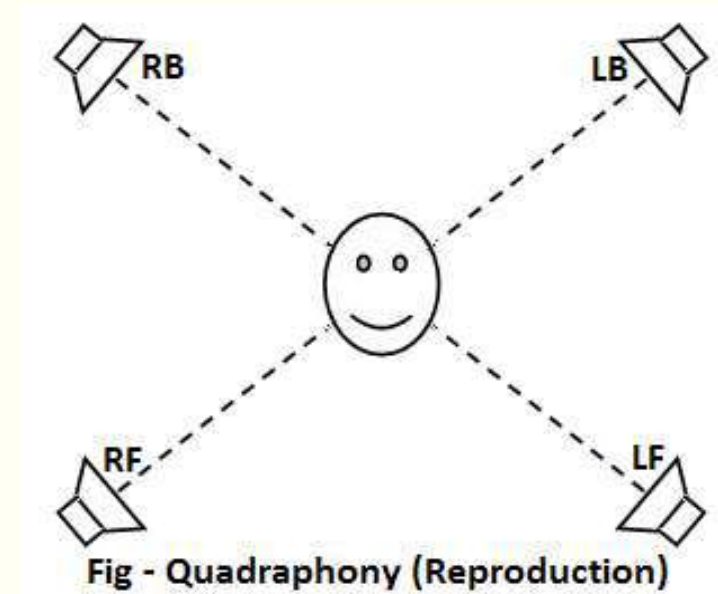
- Place two microphones 3-4 meters apart instead of 25 cm. This will enable left microphone to pick up sound more strongly from left than right.
- Sound from the middle will be picked up equally well by the two microphones.
- The output of the two microphones is fed to two separate channels of amplifiers.
- The output of each amplifier is fed to its column of loudspeakers, placed 3 to 4 meters apart.
- The column of speaker is placed in the same relative position as a microphone.
- In this way, the sources of sound have been simulated in the two speaker columns.

Practical Stereo System:



Quadraphony:

- When a listener is surrounded by four channels of loudspeakers, it is called as 'Quadraphony or Quad System'.
- This can be done by using four channels for recording and reproduction.
- While recording, two extra microphones are placed to pick-up reflection from the rear wall of recording room or concert hall.
- During reproduction, two extra loudspeakers are placed behind the listener.



Noise Reduction Techniques: Pre-emphasis & De-emphasis:

Pre-emphasis:

- During quiet passage of music, noise is more predictable
- Hence it is desirable to emphasis the low power notes before recording.
- This keeps low power notes at the higher level than noise.

Noise Reduction Techniques: Pre-emphasis & De-emphasis:

De-emphasis:

- At the receiver it is essential that the reproduced sound possesses the same production of intensities for low and high notes as were present in the original sound.
- The de-emphasis does this and brings back the original sound.
- The process of de-emphasizing in the playback circuits to bring originality is called **equalization**.
- In the playback stages, the high frequency signals are de-emphasized or reduced in intensity,
- The process, noise is also reduced. Thus signal to noise ratio is maintained.

Pre-emphasis & De-emphasis:

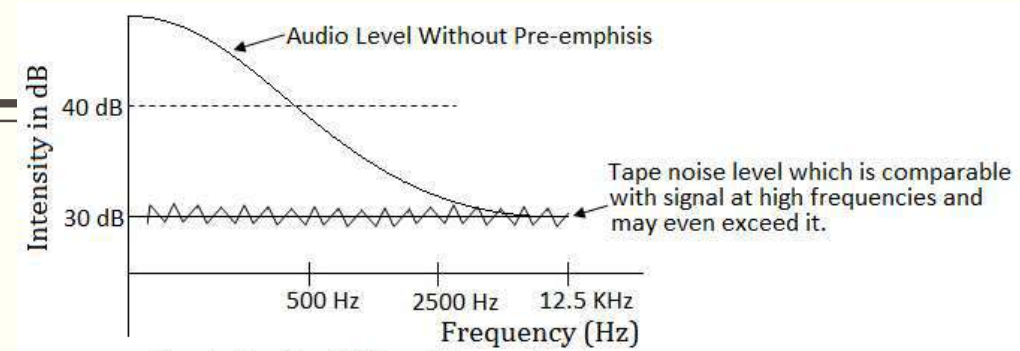


Fig - A, Position Without Pre-emphasis.

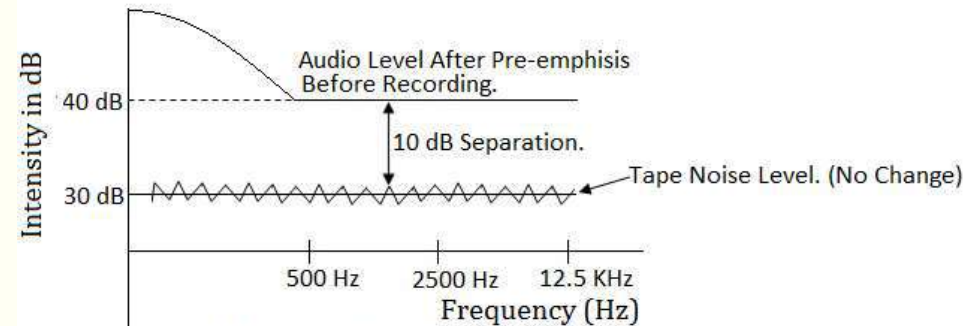


Fig - B, Position After Pre-emphasis.

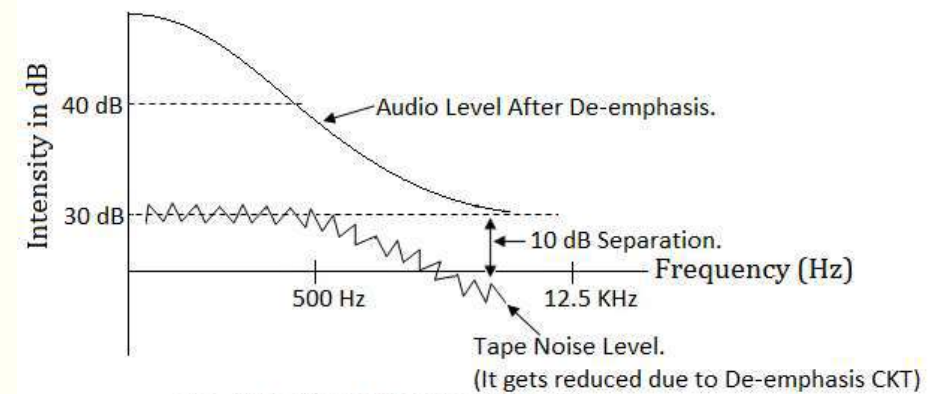


Fig - C, Position After De-emphasis.

Fig - A, B, C - Reduction of Noise by 10 dB in Dolby System.

Dolby's Method:

- **Dolby is the name given to a series of noise reduction systems.**
- **In the normal pre-emphasis it is presumed that weak intensity is present only in high frequencies, but, this is not always the case.**
- **All weak signals, irrespective of frequencies need to be emphasized.**
- **Dr Ray Dolby introduced a new system for providing 10-15 dB improvement in recording and playback system.**

Dolby's Method:

- **When the strength of signals fall a predetermined level the circuits boosts the strength before recording.**
- **The signals are at 40 dB or higher level pass the Dolby system without any change.**
- **The signal below 40 dB over the noise level are boosted by the circuits by 10-15 dB.**
- **Boosting is done before the recording.**

Dolby-A System:

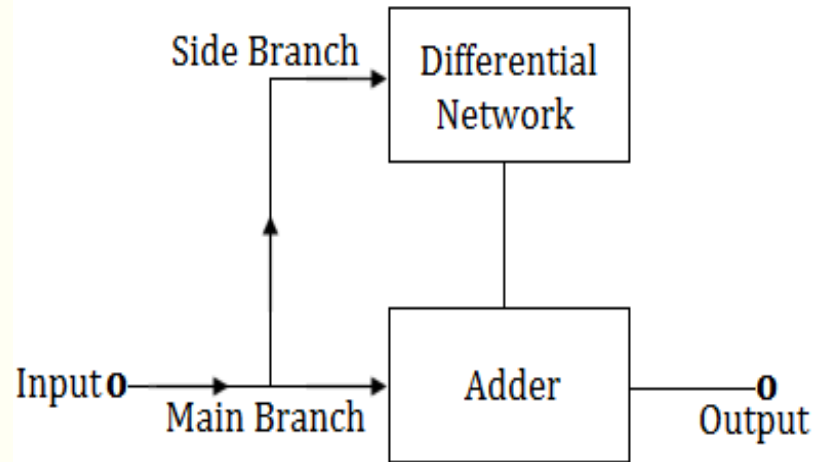


Fig - A, Coding of Signal in Dolby - A.

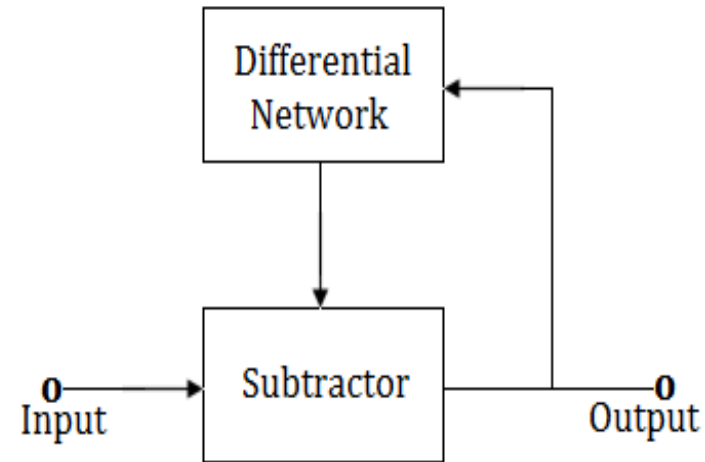


Fig - B, Decoding of Signal in Dolby - A.

Dolby A was the company's first noise reduction system, presented in 1966. The input signal is split into four frequency bands;

- Below 80 Hz;
- 80 Hz - 2999 Hz
- 3 kHz and above
- 9 kHz and above.

Dolby-A System:

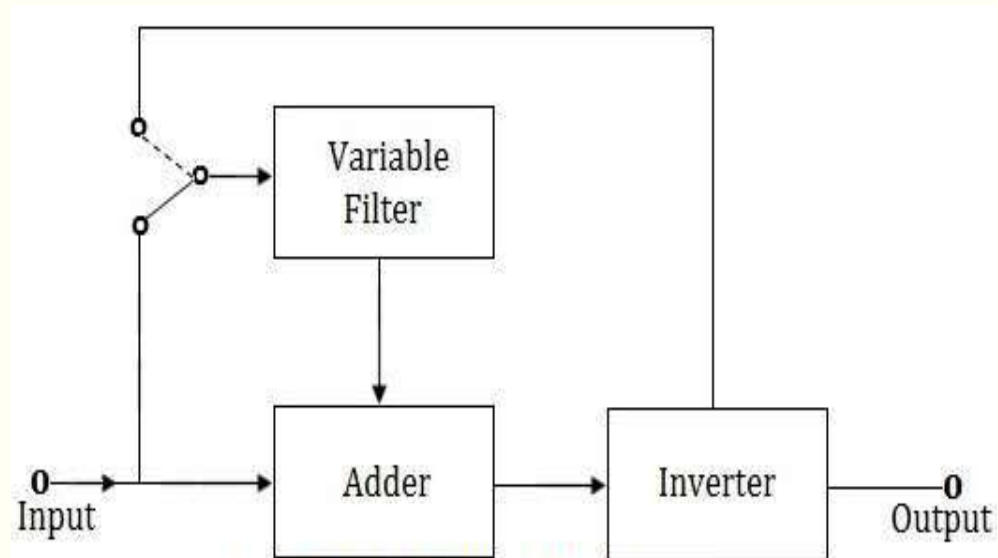


Fig - A, Basic Dolby - B System.

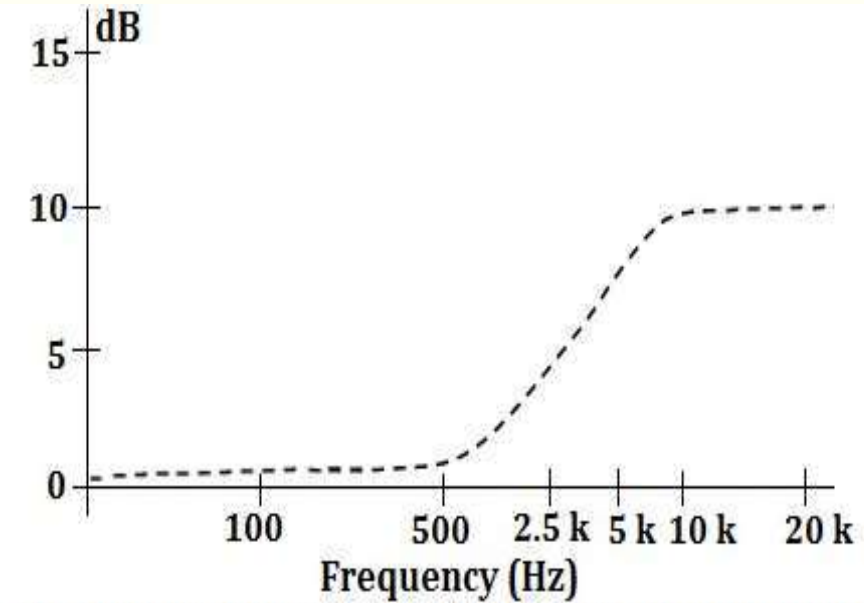


Fig - B, Signal To Noise Ratio Improvement in Dolby-B.

Playback Process of CD System:

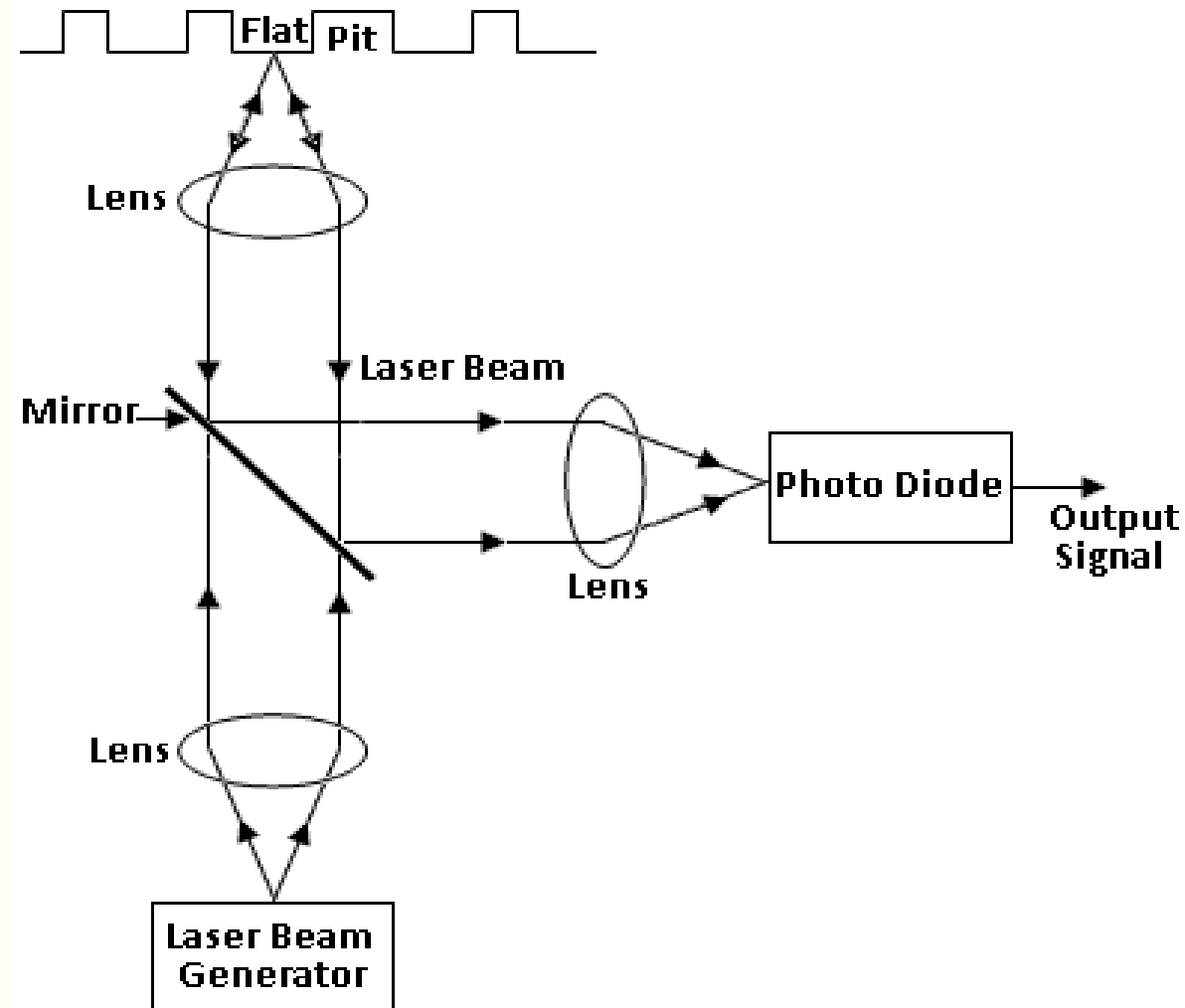


Fig - Playback Process of CD System

Block Diagram of CD-Player (CD-Detection System):

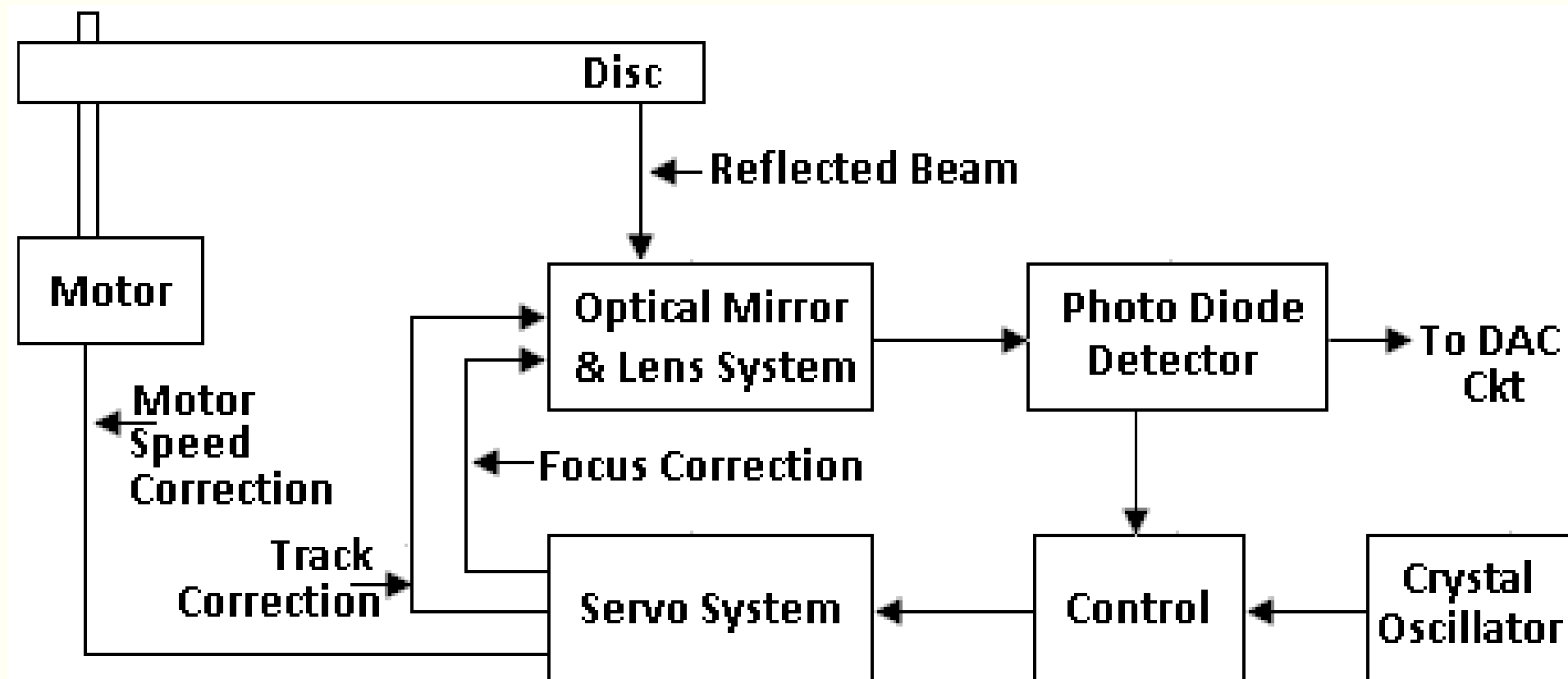


Fig - Block Diagram of CD Player.

Thank You !