38C
AUDIO AND VIDEO RECORDING

38.1 INTRODUCTION

You have already learnt about movie camera and video camera. As you know, these cameras work on the principle of persistence of vision. These devices capture movements as sequence of still photographs as frames along a strip of photographic film or magnetic tapes. You must have seen a movie on VCR or in a cinema hall. Have you ever thought, how the pictures and sound on these movies are recorded and played back at our will ? In this lesson, we will learn about various methods of audio and video recording on magnetic tapes and cine films.

The development did not come about by accident. It took a long time to reach at the present status and is based on many outstanding advantages which tape recording offers over other recording methods. On magnetic tape, sound and video quality excels, expensive processing is not required. More over payback is immediately available and tapes may be heard and used over and again at no additional cost. In this lesson, you will also learn about the structure and properties of magnetic tapes.

38.2 OBJECTIVES

After studying this lesson, you will be able to :

- *recall the structure of magnetic tapes.*
- *recognize the process of sound conversion into electrical signals and vice versa.*
- *recall the method of audio recording on magnetic tapes.*
- *draw the block diagram of recording, playback and erasual process.*
- *reason out how and why tape transport speed should be uniform during recording and playback.*

- *recognize the method of sound recording on cine film.*
- *understand the process of conversion of picture image into electrical signals.*
- *appreciate the problem of recording video signals on magnetic tape and process of overcoming it. and*
- *apply the basic principles of audio and video recording while recording the programmes on audio and video cassettes.*

38.3 MAGNETIC TAPE

You might have seen video tapes. Although they appear to be different in size, their working principle is almost same. We call them magnetic tapes also. ***Magnetic tape is a thin, plastic, flexible ribbon. It has a shiny side and a dull side. The dull side is onc, on which the recording is done. The dullness is due to a coating of oxide of magnetic material.***

Now, you will learn about the basic structure of a magnetic tape

38.3.1 Raw Material

For all magnetic tapes the basic steps of manufacturing are the same. Particles with magnetic properties are firmly placed on a base material with the help of some binders. Iron, cobalt, nickel, chromium and manganese are the basic particles that exhibit magnetic properties. Hence, various formulations of these elements are used for making the magnetic tapes. Chromium-di-oxide and Ferric-oxide are most commonly used. Most of the Beta tapes use chromium-di-oxide while most of the VHS (Vedio Home System) cassettes use Ferric-oxide. Other combinations are also used by the manufacturers. One uses cobalt energized gamma ferric-oxide while another makes use of cobalt encapsulated ferric oxide and so on.

Generally, a transparent polyester film is used as the **base material** for the tape. Selection of the base materials is also very critical, because it should be able to withstand the heavy pressure produced by heads. It should also be able to withstand the tension produced by sudden starting and stopping of the recording machine.

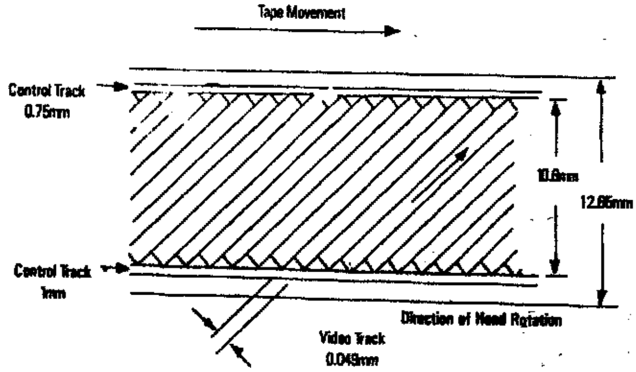

Fig. 38.1: *Recording Parameteres of VHS Tape*

38.3.2 Coating

The tapes are classified as type I, type II, etc. depending on the kind of material used for the coating. Commercially they are classified as normal, chrome, metal cassettes etc. Proper understanding of these types is very important.

Type I cassette, which uses ferric oxide coating, is called **low noise** or **LN cassette**. When the tape passes under the record-head, the magnetic particles on the tape get magnetized and behave like small bar magnets. The miniature magnets try to destroy the magnetism of the adjacent magnets. The property is called self-destruction, which results in poor frequency response, especially at high frequencies. Since at high frequencies miniature magnets are spaced closer, the self-destruction is more pronounced.

Type II is a chrome tape, which uses chromium dioxide coating. The tape has a high coercivity, the property of material to resist erasure. Because of high coercivity, self-destruction is much reduced here, resulting in a better high frequency response compared to the type I tapes.

Type III uses a double layer. A thick layer of ferric oxide is used below a thin layer of chromium oxide. Since it requires sophisticated equalization and bias arrangements, it is normally not popular.

Type IV, also known as **metal cassette**, is made from iron alloy rather than from an oxide of either chrome or iron. It has a very high coercivity and hence, its high-frequency response is extremely good.

The base material is coated with an adhesive and the magnetic particles are dispersed over this, This dispersion is done while the polyester film is moving at a speed of about 90 meters per minute. The surface irregularity has to be extremely small.

38.3.3 Tape Characteristics

The characteristics of the tape depend mainly on the nature of magnetic particles used in making them. For example, the quality of a tape is directly related to the size of the particles and non-uniformity of the particle size varies tape to head clearance, resulting in the decrease of the signal.

Another important characteristic is the **'coercivity' of the tape.** When video tape passes under the video head, particles of the tape get magnetized and behave like small bar magnets. These miniature magnets tend to destroy the magnetism of the neighbouring magnets. This self-destruction property results in a poor frequency response. The property of the magnetic particles to resist this erasure depends on its coercivity. The greater the coercivity, the lesser will be the erasure, and hence the higher will be the frequency of the tape.

38.3.4 Tape Speeds

The VHS tapes are normally identified by the letter "T" followed by a number that indicates their running time in minutes under the standard running speed. For example, T-90 means a VHS tape that can run for 90 minutes. If this tape is run in the half speed mode then of course it can run for 180 minutes. The same tape can be run for 360 minutes also under the "super long play" (SLP) mode. This mode is also known as the "extended play" (EP) mode.

38.3.5 Important Tape Parameters

Whatever may be the type of cassette used; it should be ensured that only good quality tapes are used in the machine as quality of the picture and sound depend on the quality of the tape to large extent. Low quality cassettes not only produce inferior pictures and sound but also spoil the heads. Some of the important parameters of the tapes are given below.

As mentioned earlier, the tapes should have a higher coercivity. Higher coercivity means lesser demagnetization due to self-destruction of the tiny bar magnets on the tape. It is found that after a number of playbacks, the signal output from the tape decreases. This reduction depends on certain qualities of tape, like coecivity and the bonding strength of the adhesive material used for dispersing the magnetic particles onto the base-film.

The width of the tape should be constant to avoid problems like weaving. Poor quality of plastic case of the cassette can also lead to the problem of weaving. The base polyester-film should also be of good mechanical propeties. The base film has to undergo heavy stress and if it is not capable of tolerating these stresses then the result of picture and sound will be highly distorted. Its yeild strength should also be high to avoid the breaking and tearing of the tape.

One another important parameter that can seriously affect the performance of the tape is known as '**dropout**'. The dropout means a drastic reduction in the signal strength of the tape. The following are the reason of the dropouts :

(a) the non-uniformity of the magnetic particles dispersed on the surface of the tape

(b) failure of tape to make proper contact with the head

(c) flaking away of the magnetic particles from the tape surface due to improper binding.

38.3.6 Tape Handling

Having seen some of the important aspects of the video tapes, let us briefly look at tape handling procedures to get the maximum benefit out of the tape.

The tape should be stored in the vertical position only. Store the cassette always in the cover to protect it from dust. It is found that storing the cassette in plastic covers is preferable to storing it in paper board covers because the debris from the latter create some problem in the long run and moisture can affect the tape coating.

The tape should not be stored near any source of heat. At temperatures above 55 degree celsius the adhesive material of the tape is distributed. It is a well-known fact that the tapes should be kept away from any extraneous stray magnetic fields.

If the tape is put in the "Pause" or the "Still" mode, then every minute under this mode is equivalent to a large number of playbacks. This is because of the fact that the head rotating at a speed of 1800 RPM passes through the same porting of the tape 1800 times per minute when the tape is in the "Pause" or the "Still" mode. Hence, use the tape in this mode only when unavoidable.

38.3.7 Drawbacks of Recording on Magnetic Media

As the recording on magnetic media is analogue, (you will know more about analogue in the next chapter) the tape is in constant contact with the head. The constant friction between head and the tape will wear out both tape as well as the head in due course of time causing dropouts. Dropouts are momentary signal losses due to dirt particles separating the tape from the recording or playback head or to remove the oxide coating. In roder to avoid dropouts you must use high quality tapes rather than low grade ones, which tend to shed their oxide more. Dropouts can be caused by mishandling by you. Avoid touching the tape with fingers and do not use dirty record player.

INTEXT QUESTIONS 38.1

1. *Name the materials used for the coating on the magnetic tapes (any four)*

   ....

2. *Give two characteristics of magnetic tapes.*

   ....

3. *Write three precautions during tape handling.*

   ....

4. *Name two different video tape formats.*

   ....

5. *State whether statement is true or false*

   (a) Recording on magnetic tapes is analogue not digital.

   (b) The magnetic material particles on the tape behave as small bar magnets.

38.4 THE SOUND RECORDING PROCESS ON MAGNETIC TAPE

The process, which makes recording of sound possible on magnetic tape, is very simple. The sounds to be recorded are converted into corresponding vibrations of an electric current signal with the help of a microphone. In turn, these electrical signals are amplified and induce variations of a magnetic field in a coating of tiny magnetic particles, which are bonded to a narrow strip of tape. The magnetic field variation force the magnetic particles on the tape to move to new positions in accordance with the strength of the electrical signale once moved. These particles remain stationary and magnetic record is the result.

Let us learn more about microphones.

38.4.1. Microphone

Before going to study the detailed process of audio recording on magnetic tapes, you may be curious to know how sound waves are converted into electrical waves. Therefore, first we will learn about microphone.

A microphone uses the varying pressure waves of sound to create an electrical signal. Almost all microphones contain a diaphram which moves in accordance with the varying pressure of sound waves and produce matching electrical waves. In a condenser microphone, the diaphragm forms a part of the capcitor a device which stores electrical charges. As the diaphram moves in and out, the voltage across the capacitor varies in accordance with the vibrations and reproduces electrical variations corresponding to sound waves.

In a moving coil, microphone diaphragm is attached to a coil of wire suspended in a strong magnetic field. As the diaphragm vibrates, a voltage is generated in the coil, causing a current flow. Another design has a diaphragm mounted on a piece of piezo-electric material. This produces a varying voltage as it is compressed by sound waves.

38.4.2 Functions of Tape Recorder

A practical tape recorder performs three essential functions :

Recording, reproduction and erasure. The method of accomplishing these basic functions will now be briefly explained.

(i) Recording : The block diagram of recording process is shown in Fig. 38.2. low-level incoming audio signals (block A), corresponding to the sound variations to be recorded, are introduced to the recording amplifier (block B). the signals are electronically amplified in the recording amplifier and then fed to the recording head (block C).

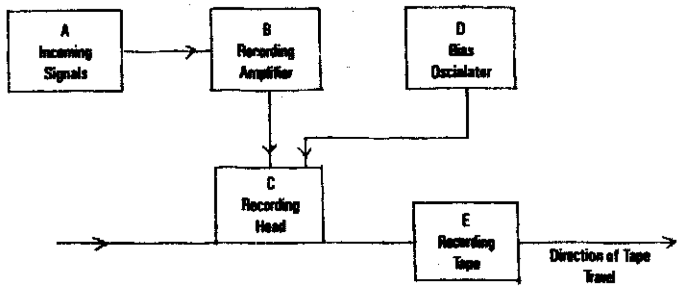

Figure 38.2 : *Block diagram of recording process.*

A bias oscillator proved to be the crucial factor responsible for high quality of the recorded signals, (block D) is combined with the amplified audio signals at the recording head.

The recording tape (block E) is in contact with and drawn across the recording head. To draw the tape across the head, a complex device known as tape transport or tape drive mechanism, is used.

(ii) Reproduction : For reproduction of the recorded signals, the magnetic record preserved on the surface of the tape must be scanned magnetically and then amplified to enable audio reproduction. The block diagram for reproduction process is shown in Fig. 38.3.

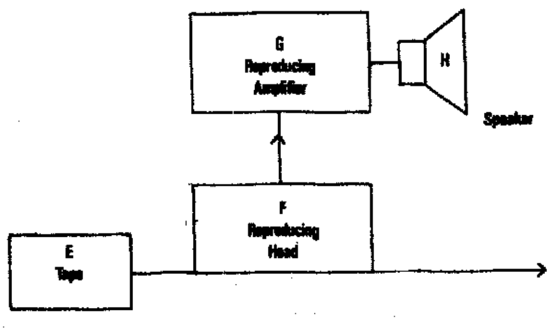

Figure 38.3 : *Block diagram of reproduction process.*

During the reproduction the tape (E) is in contact with and travels past the reproducing head (F), the speed and direction of travel must be the same as used during the recording process. The fixed magnetic pattern on the tape then induces voltage variations in the windings of the reproducing head. The voltages vary in accordance with the recorded pattern of coated particles on the tape. The resulting signals are amplified by the reproducing amplifier (G) and made audible through a loudspeaker (H).

(iii) Erasure : It is the third magnetic process. A magnetic field of considerable magnitude is applied to the tape to erase the recorded signals. The block diagram for erasure is shown in Fig. 38.4

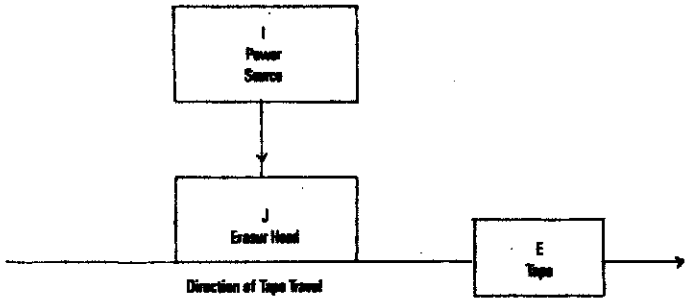

Fig. 38.4 : *Block diagram for erasual process.*

A power source (I) energizes an erasur head (J) and a magnetid field of great intensity is produced by this erasur head, while the tape (E) is in contact with and drawn past it. The aroused magnetic field then overpowers the recorded pattern of the aligned magnetic particles coated on the tape and the particles are disoriented by the field coming to rest in random positions. This action results in complete erasure, leaving the tape ready for new recording.

38.4.3 Recording Process

The magnetic tape recorder has contributed a superior method of recording to the field of communications and home entertainment. It is a method far more flexible and economical than any other known method. The impact and importance of tape recorder is demonstrated by their acceptance by all major recording and motion picture studios.

Recording on tape is done by magnetizing the tape in accordance with the sound waves. The process depends on the capability of tape becoming magnetized when brought in the magnetic field and retaining the magnetism. For recording, the tape is moved past an electromagnet known as recording head. The amplified audio signals are given to this head. The field produced by the head, therefore, varies in accordance with the sound signals.

38.4.4 Heads

In a tape recorder, heads are required to perform the functions of record, playback and erasure.

Though, many commercially available tape recorders have a single head for both recording and playback, the better method is to have two separate heads for two different functions, because the basic requirements for the two heads are different.

The playback head should have a large number of winding turns, as its signal output increases with the number of turns. But the record and the erase-heads should have relatively smaller number of turns to facilitate developing a strong magnetic field on tape.

All heads have two windings on the core, on each arm of the gap as this symmetrical construction can aid cancelling out the hum. In playback head, the two windings are in series to increase the voltage output. The record and erase head windings are connected in parallel to increase the current, so that strong magnetic field is created.

The width of the head gap governs the high frequency response as given by the formula :

$$F = \frac{s}{2g}$$

Where *s* is the speed in cm/sec. , *F* is the highest frequency and *g* is the head gap in cms. If *g*=0.000635 cm. and *s*=4.7625 cm/sec, the highest frequency that can be reproduced satisfactorily will be 3750 Hz.

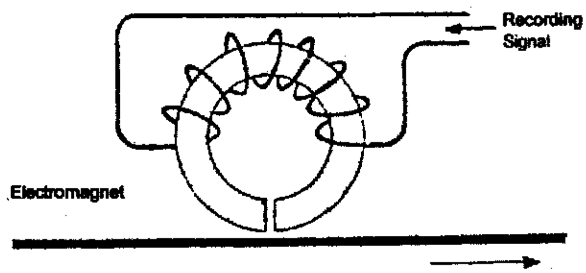

Fig 38.5 : *The development of the record head*

Modern tape recording employs a ring shaped electomagnet made up of soft iron with a small air gap between the two ends of the ring, which are its magnetic poles (Fig. 38.5). Magnetic flux emitted from the air gap causes a magnetic change within the tape. This change creates a longitudinal magnetic recording.

There is another type of magnetic recording called azimuthal recording used in video signals. You will learn about this in the later part of this lesson.

As the tape drawn passes the recording head's air gap, the tape particles are subjected to the magnetizing force along the direction of tape travel and are turned in the direction of the force. After the portion is out of the air gap, the orientations of the magnetic particles stay fixed. The magnitude and the polarity of the magnetizing field is a function of the magnitude and the polarity of the signals introduced by the windings of the recorder head. The materials used for the core of the recorder-head have very high initial permeability, very low hysteresis losses and low eddy current losses.

38.4.5 Erasing

Recording is done on the tape by magnetizing its different points differently according to the input signals. But, before recording, one must make sure that there is no previous magnetization present on the tape. This demagnetization is called **erasing**. This can be done either by demagnetizing it or fully magnetizing (saturating) it. The first method i.e. demagnetization is most common now-a-days.

A seperate head known as erase head is used for erasing. A signal of considerable magnitude from an ultrasonic power oscillator is applied to the windings of the laminated erasure head which is similar in construction to a ring type recording head.

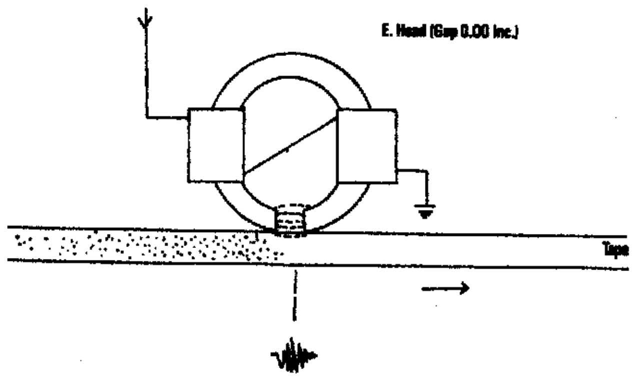

Fig 38.6 : *Improved modern method of high frequency erasure*

This is the most popular erasing technique. Several requirements must be met. However, for proper operation, first, the erasure signal must be of greater magnitude than any signal it is required to erase. Secondly, the erasure gap must be wider than the recording head gap.

As the recording tape is near the high frequency field of erasure gap, each magnetic particle becomes magnetized first in one direction and then in the other, due to rapidly reversing field. As the particles cross the center of the gap they are saturated and the previous recording is completely erased. The result is that all residual magnetism is removed and the tape is left in virgin or natural state. The tape so erased has very low noise component when used again.

38.4.5 Tape Transport Mechanism

For recording or playback, the tape has to be carried past the head at a uniform speed. For faithful reproduction, it is essential that the tape speed is maintained accurately at the specified value and there are minimum variations in it. Also, while playing back, the tape speed should be exactly equal to the speed at which the recording was done. Any variation in speed between recording and playback will cause the sound to be unnatural.

The capstan and pinch arrangement is used in cassette tape recorders for running the tape during recording and playback. In this arrangement tape is pressed between two cylindrical parts. One of these known as **capstan**, is driven by the motor and the other is known as **pinch roller or pressure roller** is kept pressed on it by a spring and rotates with it. The tape whicn is pressed between the two also moves along.

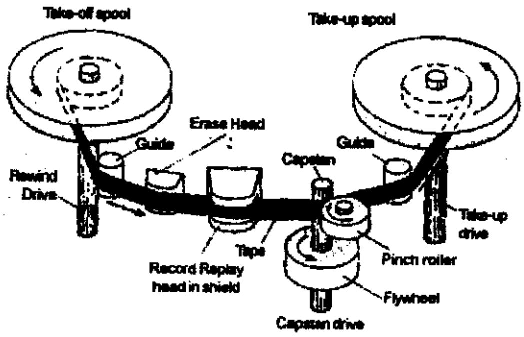

Fig 38.7 : *Standard reel to reel system.*

In this arrangement, the tape speed depends on the diameter of the capstan and the number of revolutions it makes per second.

Tape speed = D x N

Where, D=3.14 d, d is the diameter of the capstan and N is the number of rotations per second.

For the tape speed to be steady and free from fluctuations, the capstan should have no eccentricity (must be perfectly round). A number of arrangements are also made to stabilize the speed of the tape. These are given below.

1. The capstan is mounted on a flywheel which is balanced accurately and keeps down the fluctuations due to intertia.
2. Two tape guides are provided in the path of the tape and friction on these also helps in stabilizing the speed.

Note : After repeated use there are wows and flutters in reproduction. This is due to variations in speed caused in different sub mechanisms. Compact Disc(CD) is a device which is free from these defects.

INTEXT QUESTIONS 38.2

1. Name the instrument which coverts

(a) sound into electrical signals

(b) electrical signals into sound.

....

2. Name three essential functions, a tape recorder performs.

....

3. Write the formula for the tape speed.

....

4. State whether the following statements are True or False.

a) Capstan is the most improtant part of the tape transport mechanism.

b) Head gap should be bigger than the target wavelength to be recorded.

c) A single head can perform all the three functions of recording, playback and erasure.

38.5 SOUND RECORDING ON CINE FILM

Sound recording on cine film is usually achieved photographically by producing an expose on film proportional to the instantaneous audio signals. This method is called optical sound recording. The optical sound track used in motion picture are of two kinds: variable area and variable density. While the recording mechanism is different, playback is carried out by identical units.

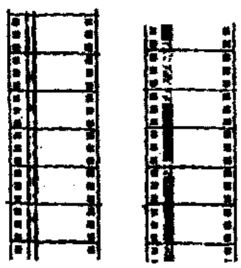

Fig 38.8 : *Film strips with (a) variable area, (b) variable density sound records*

In both types of optical recording, the basic system consists of a beam of light which is focussed to form a narrow horizontal strip of light which moves along a special light sensitive track at one edge of the film. In the variable area system, the length of the strip can be varied by means of a mirror galvanometer to which the audio signal is fed. As the galvanometer follows the audio waveform, the strip of light varies rapidly in length, producing a strip of varying width on the film emulsion as it moves along.

In the case of variable density recording, the light beam is modulated by means of a pair of vertically moving ribbons, which act as a gate in the light path, varying the intensity of the light beam and so the opacity of the strip, which is of constant width.

For playback the process is basically simple. A tiny beam of light is projected through the sound track at the edge of the film, passing on to a light sensitive cell. Originally a conventional photoelectric cell was used, but the newer solar cell is more efficient and is now commonly used.

The film passes, the projection gate in jerks, remaining momentarily still for the duration the light shutter opens and moving on to the next frame each time it is closed. But for continuous sound reproduction from an optical sound track, the film should move at constant speed.

This means that synchronized sound connot be recorded on the film directly opposite the pictures to which it relates. In practice, the sound is recorded 20 frames ahead of the picture on 35mm films and 26 frames ahead in the case of 16mm. After the film has passed the mechanism hitch, it moves intermittently past the projection gate, it moves on to a flywheel stabilized socket to ensure constant speed as it passes the sound pick up station. A similar system is used in the optical sound camera.

INTEXT QUESTIONS 38.3

1. ***State whether the following statements are True or False***

   a) *Sound recording on cine film uses the method of optical sound tracks.*

   b) *Sound on cine film is recorded just in front of the relative picture.*

   c) *A solar cell is used for the playback of sound from the cine film.*

38.6 VIDEO RECORDING

As we know that a VCR can record only electrical signals on the magnetic tapes, therefore it is necessary to know, how a picture image is converted into electrical signals (Video Signals).

38.6.1 Conversion of Picture in to Electrical Signals

As in the case of audio recording, sound waves are first converted into electrical waves (signals) with the help of a microphone, similarly, in video recording light signals are converted into electrical signals by a television camera. The detailed description of this conversion is given below.

The optical system of T.V. camera focusses an optical image of the scene on photosensitive plate in the camera and the picture elements of varying light intesities are converted into corresponding varying electrical signals by process of scanning. The electrical signals so formed by scanning the picture image by an electron beam are called video signals. These signals are amplified before recording. The block diagram for the same is given in the Fig. 38.9 given below.

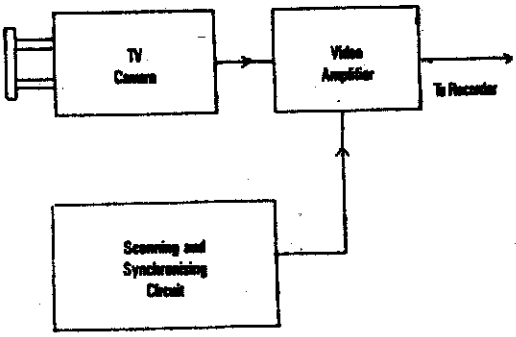

Fig. 38.9 : *Block diagram for producing video signals*

38.6.2 Scanning

Scanning is the process by which the optical image formed on the photosensitive plate of the T.V. camera is broken into a series of horizontal lines by an electron beam. This electron beam sweeps across each line at a uniform rate, then flies back to scan another line directly below the earlier one and so on. It goes till it reaches the bottom of the picture. As the electron beam sweeps across the line, it falls over portions of different light intensities and is, accordingly converted into electrical currents of different magnitudes. Higher the illumination, greater is the current amplitude. For continuity of motion each picture frame is scanned 25 times per second and each picture frame is scanned by 625 lines. It means that total number of lines scanned each second is 625×25=15625

38.6.3 T.V. Camera

A T.V. Camera performs the dual functions. First, converting the optical image into an electrical image and then scanning this elecrical image with an electron beam to produce electrical signals which vary in accordance with the variation of light intesities in the picture elements of the scanned electrical image.

Working : An optical image of the object is focused on a mica screen on front side of which millions of globules of silver are deposited with a surface coating of cesium oxide which is a photosensitive meterial. The other side of mica sheet is coated with a conducting film of graphite called the signal plate. These two thin coatings with mica within forms a capacitor. When light falls on The photosensitive globules they emit electrons beams and, positively charged particles. The amount of charge, thus deposited on a particular point of the image depends on the intensity of light falling at that point. This surface, thus, gets a charge distribution in accordance with the variation of light intensity in the original optical picture. Thus, an electrical image of the object is formed.

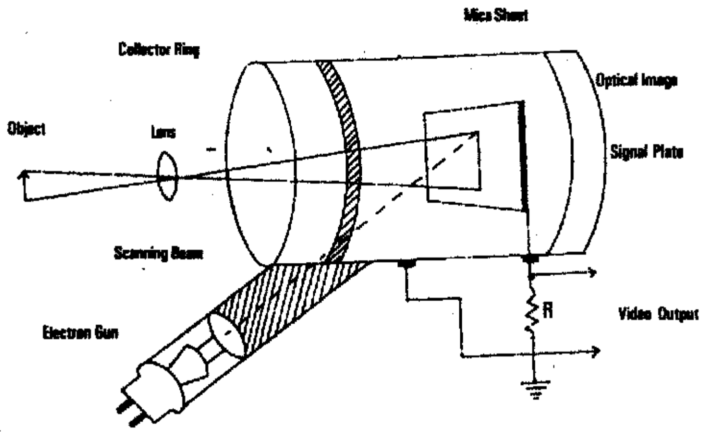

Fig 38.10 : *Scanning of electrical image by a narrow beam*

The electrical image is scanned by a narrow electron beam from the electron gun and deflected horizontally and vertically by deflection coils. As the electron beam scans the positively charged surface elements, it gives back the electrons lost by emission. The capacitance associated with the picture current is proportional to the intensity of the light with which the particular picture element has been effected. The capacitor discharge current passes through the load resistor and a voltage called the video signal, is developed across the load resistor. This video signal, is then amplified by video amplifier before being recorded or transmitted.

38.6.4 Problems in Recording the Video Signals on a VCR

In audio recorder, the frequencies from 50Hz to 10k Hz are recorded. while in VCR frequencies from 50 kHz to 5.5 MHz are recorded. It means. very high frequencies present in video signals need to be recorded. So the video head used in VCR must be far superior in quality.

For this, the gap of the magnetic head must be as small as possible, since the gap of the head is equal to the half wavelength of the video signals

$$\text{Gap of video head} = \frac{\text{Tape speed in cm/sec}}{2\times \text{ signal frequency in Hz}}$$

From the above, it is clear that the gap of the video head should be very small i.e. of the order of 0.3 microns to 0.5 microns, in order to record the highest frequency signals.

In audio tape recorder the heads are stationary and tape runs horizontally at the speed of 19cm/sec for good quality sound recording. The highest frquency in audio recording is 20 kHz, whereas in video it is 5.5 MHz. that is, 275 times higher. Hence, the tape speed required is 5225 cm/sec or 188 km/hr. This situation suggests that audio recording technique cannot be used for video recording.

38.6.5 Rotating Video Head

The technique adopted for video recording is rotating video head. In this technique the relative speed of tape with respect to video head is very high as the head rotates at a speed of 25 revolutions/sec in horizontal plane while the tape moves diagonally at a speed of 2 cm/sec. This is known as helical scan system. In this system diagonal tracks or slant tracks are produced.

Here. two video heads are fitted 180° apart in a cylinder and the tape is passed round the drum as a helical wrap and then transported at a fairly low speed (called as scanner) which rotates at a speed of 1800 rpm (30 rev/sec). Hence, each head comes in contact with the tape in 60 sec and therefore, one diagonal track is recorded at 60 sec. If head 'A' records during the first 60sec, head 'B' records during the next 60sec. Therefore, recording continues in the pattern of A-B-A-B and so on. Figure 38.11 shows a simplified diagram of relationship between the video heads and video tracks recorded on the tape.

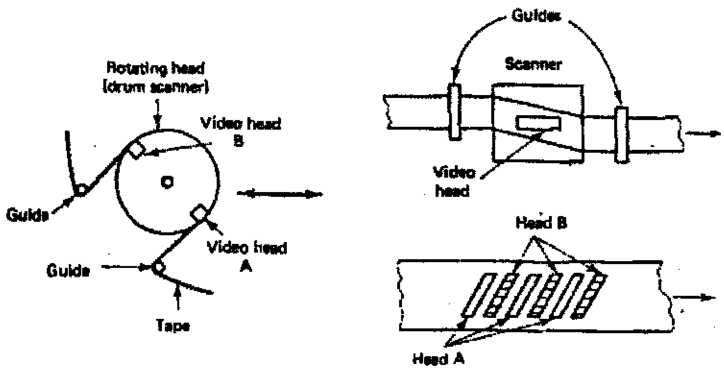

Fig 38.11 : *Simplified diagram of the relationship between the video heads and the video tracks recorded on tape.*

In television broadcast, one frame consists of two fields and each field is scanned for 60sec. Hence, theoritically we can presume that one field of the video signal is recorded in one diagonal track of the tape and hence two fields are recorded side by side in adjacent diagonal tracks say A and B. But, in actual practice, there is always some overlapping between the two tracks. During playback this overlap is eliminated by electronic switching so that the output from the two heads appears as a continuous signal.

In audio tape recorder only one speed control is required and that is of the tape transport. As long as this speed remains constant, and the tape record and playback speeds are reasonably close, the result will be acceptable. This is not the only case with VCR. In the first place the tape speed must not only be constant. it must also be accurate. The slightest inaccuracy will put the diagonal tracking of the video heads off their path and the hi-fi picture can not be reproduced.

There is only one method of achieving such great accuracy of movement of both the tape and of the rotating heads during recording and playback. It is done by means of automatic correction mechanisms known as servo systems.

INTEXT QUESTIONS 38.4

State whether the following statements are True or False

a) The frequency range for video recording is 50 kHz to 5.5 MHz.

b) In a VCR, rotating double head system is used.

c) A VCR has three different heads.

d) The tape speed in a VCR is very high.

e) The picture image is converted into electrical signals (video signals) with the help of a T.V. camera.

f) The video tracks on a video tape are horizontal.

g) The two video heads are 180^0 apart.

38.7 WHAT HAVE YOU LEARNT ?

- Video tapes are thin strips of a base material coated with a magnetic material mixed in gelaten and base is, normally, a transparent polyester film.
- Iron, nickel, cobalt and chromium oxides are used as magnetic material.
- As the tape passes through the recording head, the particles of the magnetic material get re-oriented and start exhibiting special magnetic behavior.
- Size and nature of magnetic particles determine the quality of magnetic tapes.
- Tapes should be stored in plastic course, in vertical position. We should not touch them and should keep them away from sources of heat.
- Recording on magnetic tape is analogue, and remains in contact with playing head during reproduction.
- A practical tape-recorder performs three mains functions : recording, reproduction and erasure and seperat heads are provided for these functions in good record players.
- To carry the tape past the head, during recording or playback, at a constant speed a special reel to reel transport mechaism is used.
- Sound recording on films is done by optical methods. There are two different methods of recording, variable area and variable density, but same mechanism is used for play back.
- For video recording the video image is scanned by an electron beam giving rise to electrical signals varying in accordance with the image.
- A rotating video head is used for video recording.

38.8 TERMINAL QUESTIONS

1. Give three advantages of magnetic recording over disc recording of old times.
2. What do you mean by erasing and why is it necessary ?
3. What is a transport system ? State the precautious which are necessary in a transport system.
4. Explain the working of microphone.
5. Explain the scanning process of a T.V. camera.

6. Why video signals can not be recorded so easily as audio signals.
7. How is the relative speed between tape and video head is increased?
8. Draw the block diagrams of :
   a) sound recording process
   b) reproducing (playback) process
   c) erasual process

CHECK YOUR ANSWERS.

Intext Question 38.1

1. Iron, Cabalt, nickel, chromium.
2. Particle size and coercivity.
3. (i) Store the tape in veritical position.
   (ii) Store it in a plastic cover.
   (iii) do not touch its recorded surface with hand.
4. LN Cassettes and metal cassettes.
5. (a) T (b) T.

Intext Question 38.2

1. (a) Microphone
   (b) Loudspeaker
2. Recording, playback, erasure.
3. Tape speed = 3.14 dn, where d = diameter of the capstion and n = number of rotations it makes in 1 Second.
4. (a) T (b) T (c) F

Intext Question 38.3

1. (a) T (b) F (c) T

Intext Question 38.4

1. (a) T (b) T (c) F (d) F (e) T (f) F (g) T