

Television

1. INTRODUCTION

- Television – “far sight” .. to see from a distance
- Earlier – Selenium photosensitive cells were used for converting light from pictures into electrical signals
- Real breakthrough – invention of CRT
- First Camera tube – iconoscope
- 1935 – TV broadcasting started
- 1959 – in India

Television Systems

Three Monochrome Systems developed

- 525 line American
- 625 line European
- 819 line French

UK – 415 line – but changed to 625 line system

India – 625B Monochrome system

Colour TV standards

NTSC – National television Systems Committee
USA – 1953

adopted by Japan, Canada

PAL – Phase Alteration by Line

Germany – reduces colour display errors

adopted by UK, Australia, Spain,

India(compatible with 625B)

SECAM – Sequential a memorie

France – 1967

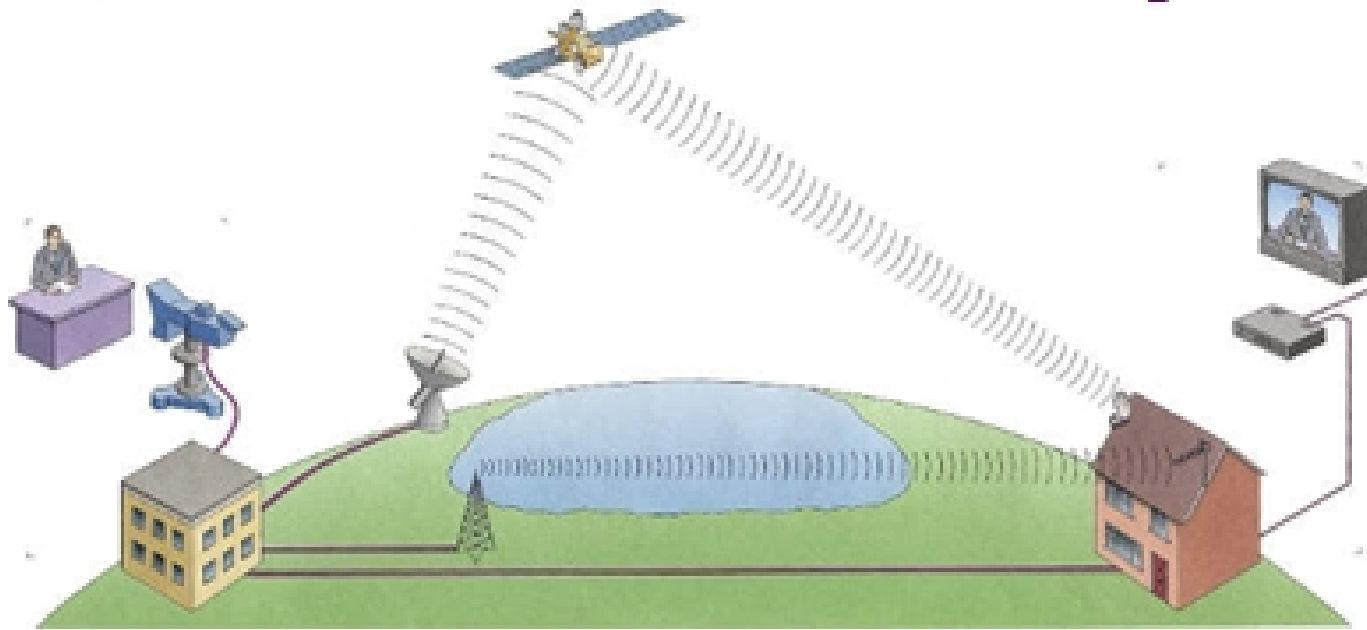
SECAM IV & V – developed at National Institute of Research, Russia and called as NIR-SECAM :
adopted by Hungary

Deciding factor for adoption : compatibility with the already existing monochrome system

Band Width, Frequency Band & Coverage

- **Band Width** : Around 7 MHz
 - America – 6 MHz
 - British – 8 MHz
 - France – 14 MHz
 - **Frequency Band** :
 - Started in VHF band: 41 – 68 MHz & 174 – 230 MHz
 - Later added UHF band : 470 – 890 MHz
 - **Coverage**: limited to Line of Sight distance: 75 – 140 Km
 - can be extended by relay stations
- /satellites

Transmission of Audio and Video Signals



- ◆ The image captured is combined with other electronic content (text and graphics) plus audio.
- ◆ The combined image is amplified and transmitted via AM (amplitude modulation) and FM (frequency modulation) carrier waves to either a satellite feed or from direct transmission to a television receiver.

The receiver decodes the signal



- The electronic signal is decoded by the receiver; splitting the FM wave to the audio section and the AM wave to the video section of the television.
- <http://www.howstuffworks.com/tv.htm>

ELEMENTS OF A TELEVISION SYSTEM

- Fundamental aim : To extend the sense of sight beyond its natural limit along the sound associated with the scene

- In 625 line monochrome system:

Picture signal - amplitude modulated

Sound signal – frequency modulated

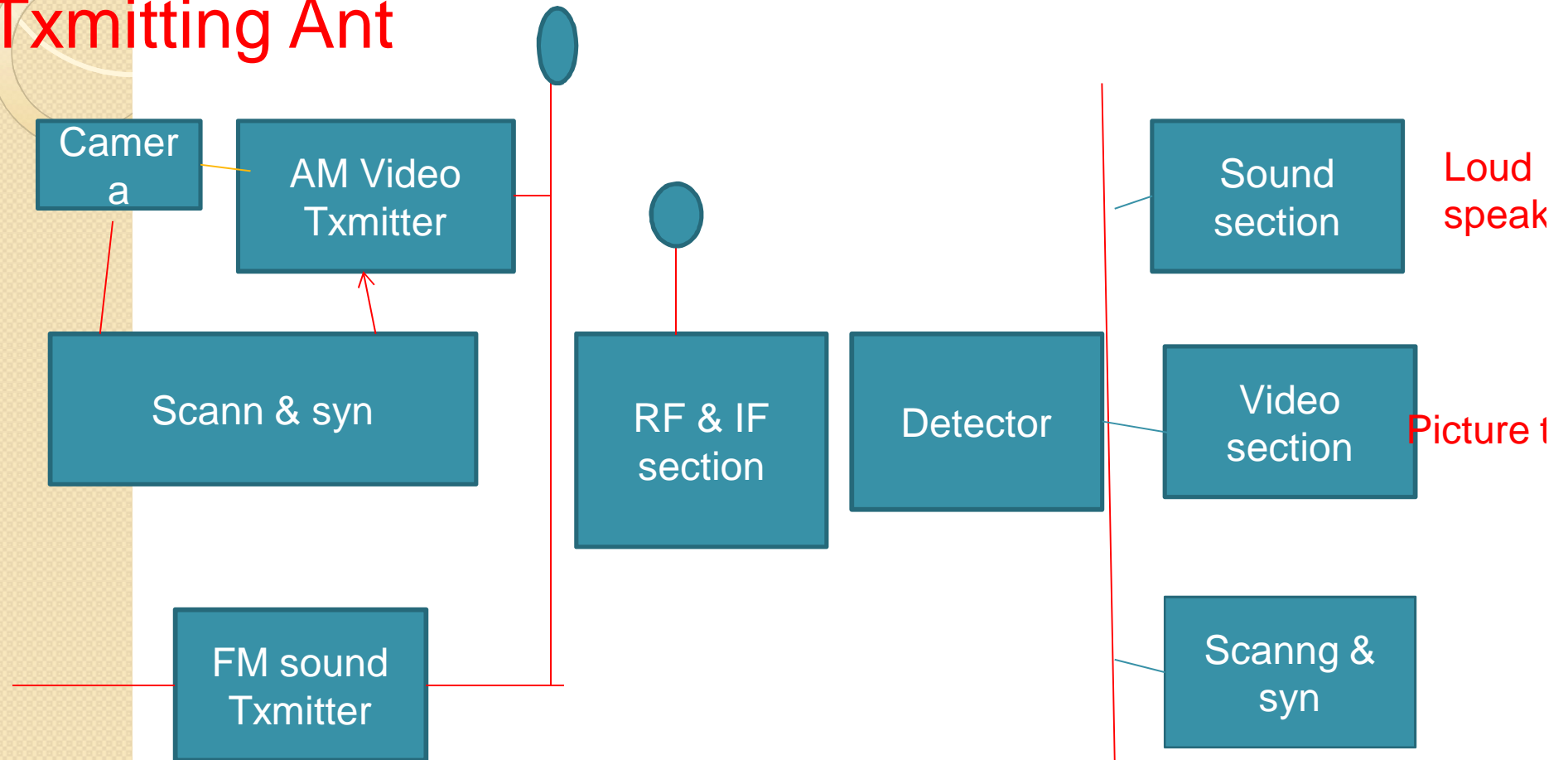
Carrier frequencies are suitably spaced and modulated outputs radiated through a common antenna

Picture Transmission

- **Picture information** – optical in character – assembly of a large number of bright and dark areas, each representing a **picture element** – infinite number of pieces – existing simultaneously
- Information is a function of two variables: *Time and Space*
- Instead of using infinite number of channels simultaneously, we use *Scanning*
- *Scanning: Optical information is converted into electrical form and transmitted element by element, one at a time in a sequential manner to cover the entire scene to be televised*
- - *done at very fast rate*
- *repeated a number of times per second to create an illusion of simultaneous pick-up*

Basic TV system

Transmitting Ant



Basic Monochrome Television Transmitter

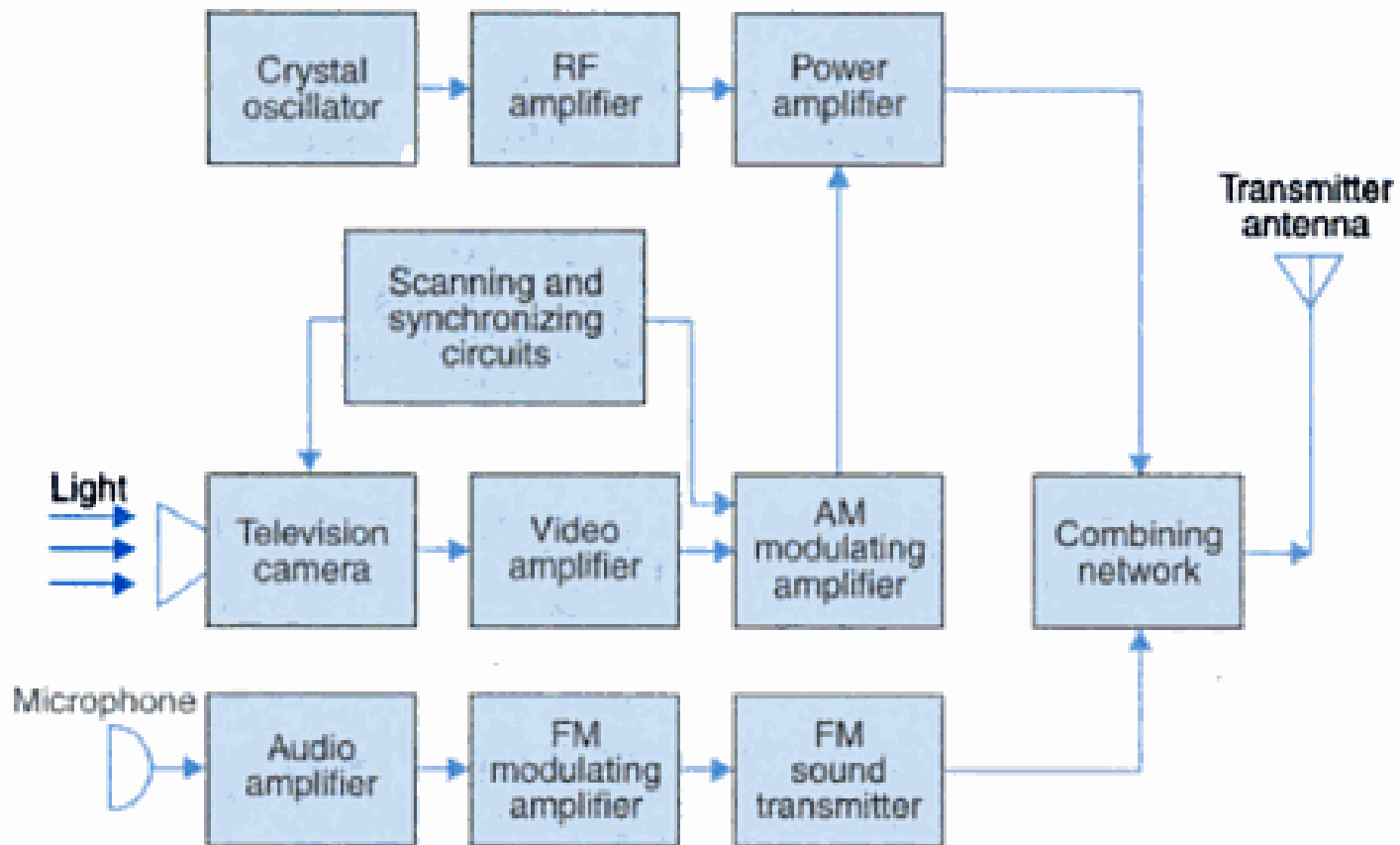


Fig. 1.1 (a) Basic monochrome television transmitter.

Basic Monochrome Television Receiver

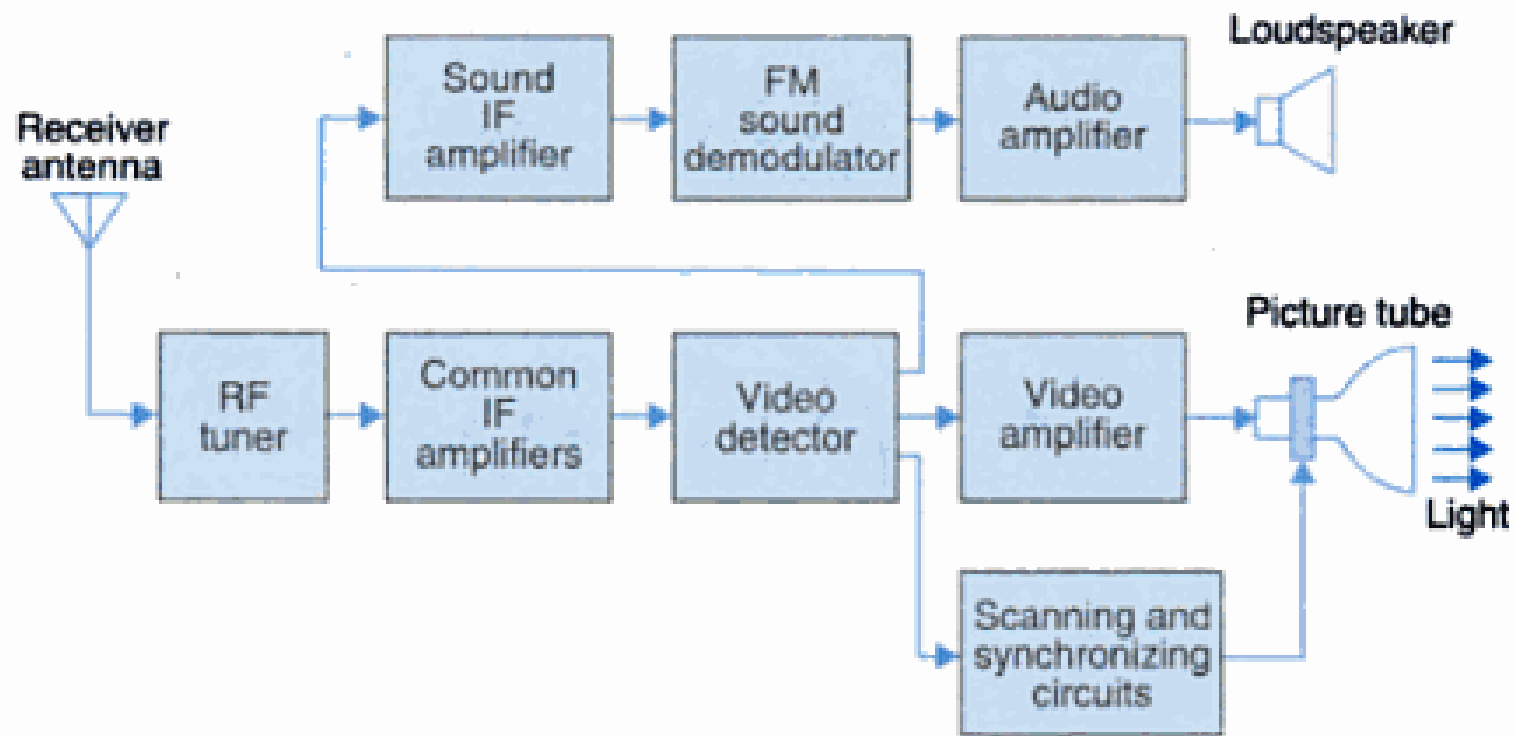
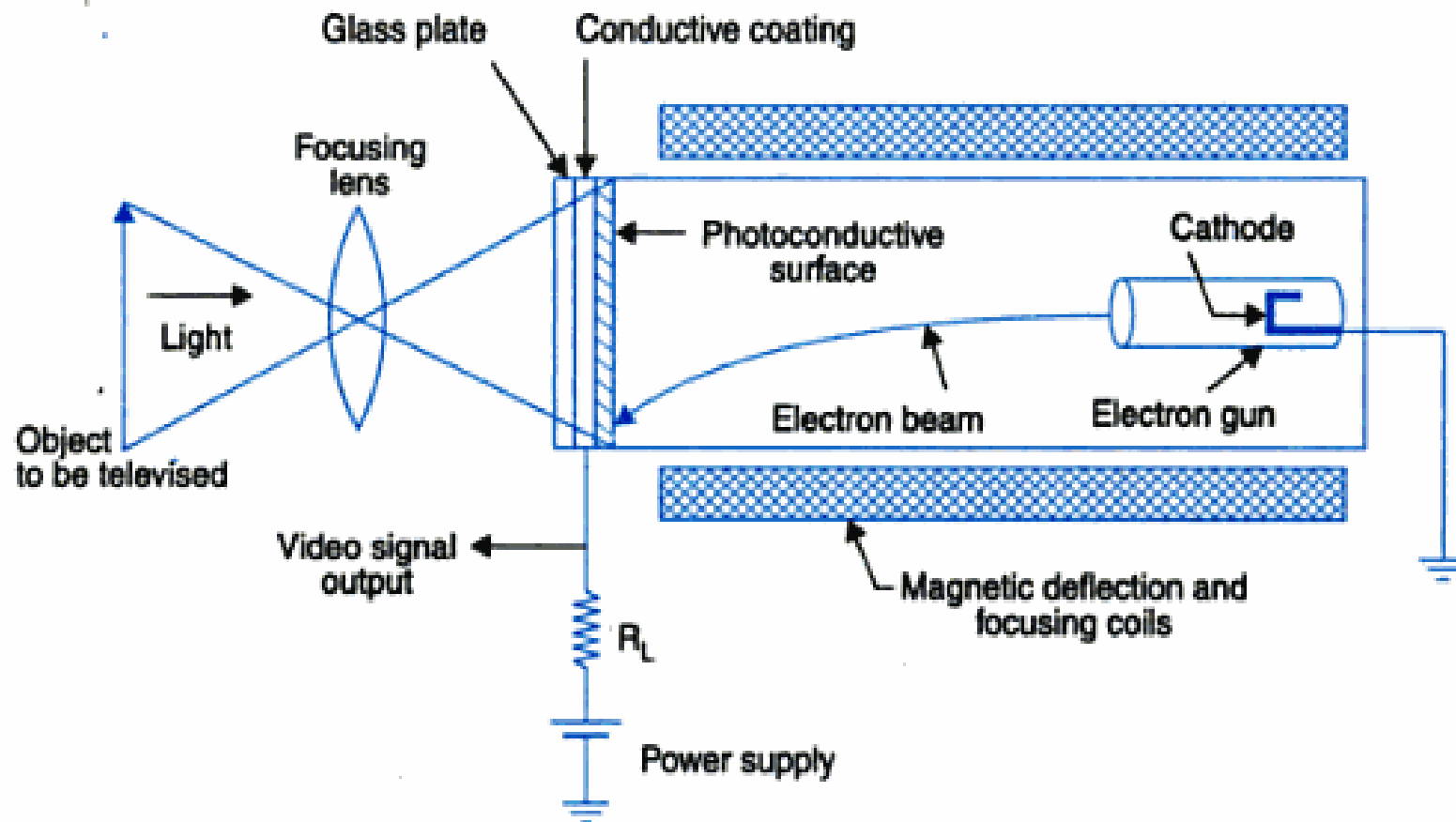


Fig. 1.1 (b) Basic monochrome television receiver.

Simplified cross-sectional view of a Vidicon TV camera tube



TV Camera

- Heart of a TV camera is a Camera tube
- Camera tube – converts optical information into corresponding electrical signal
- Amplitude proportional to brightness
- Optical image is focused by a lens assembly to a rectangular glass face-plate
- Transparent conductive coating at the inner side of the glass face-plate
- On which is laid a thin layer of photoconductive material – having a very high resistance when no light falls on it.
- Resistance decreases when the intensity increases
- Electron beam – used to pick up the picture information available on the target plate in terms of varying resistance
- Beam is formed by an electron gun – deflected by a pair of deflection coils kept mutually perpendicular on the glass plate - to achieve scanning of the entire target area

- Def
con
diff
- Use
- Def
R)
trac
- Def
its
aga

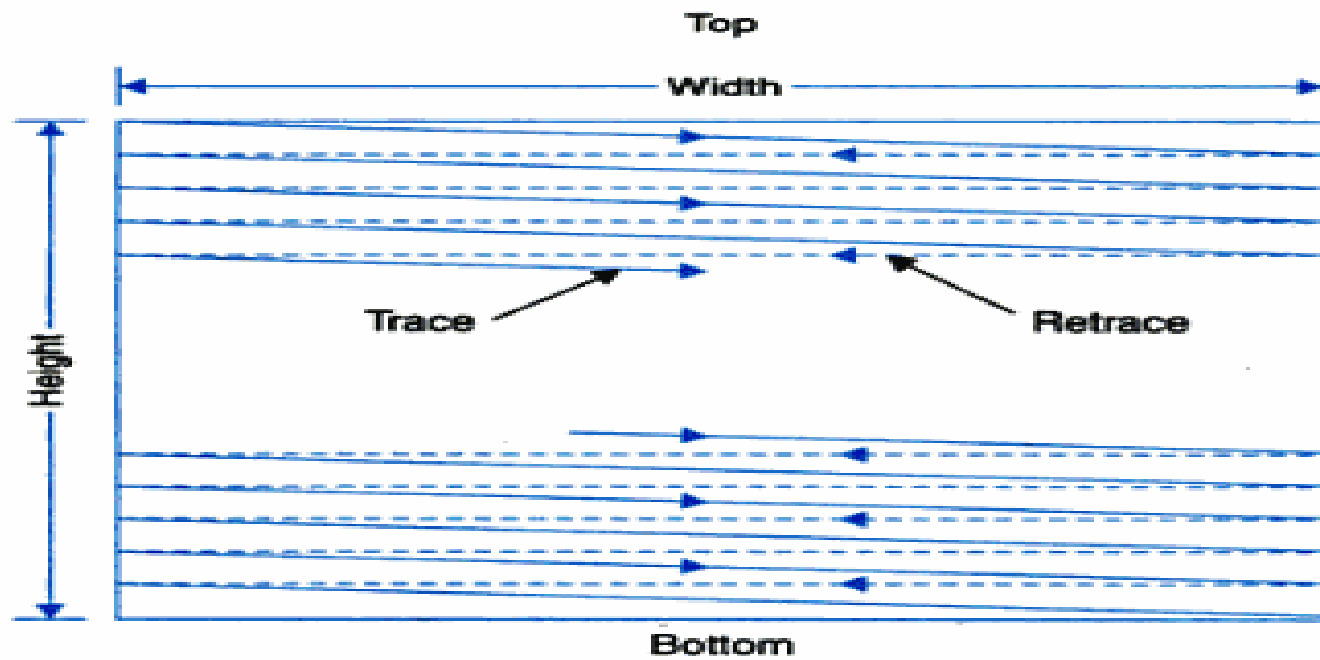
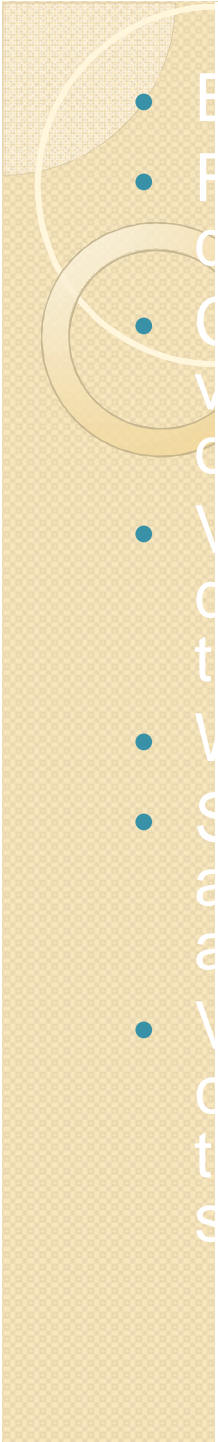


Fig. 1.2 (b) Path of scanning beam in covering picture area.



Sound Transmission

- Microphone converts the sound associated with the picture into proportional voltage
- Single valued function of time – so needs a single channel
- Amplified – frequency modulated using assigned carrier frequency – combined with the AM picture transmitter output – fed to common antenna – radiated in the form of electromagnetic waves

Picture reception

- Receiving antenna intercepts the radiated picture and sound carrier signal – feeds to RF tuner
- Receiver – heterodyne type
- Employs 2 or 3 stages of IF amplification
- Demodulated to recover video signal
- Amplified and coupled to picture tube (same as CRT) – which converts the electrical signal back into picture elements – with same degree of black and white

Picture Tube

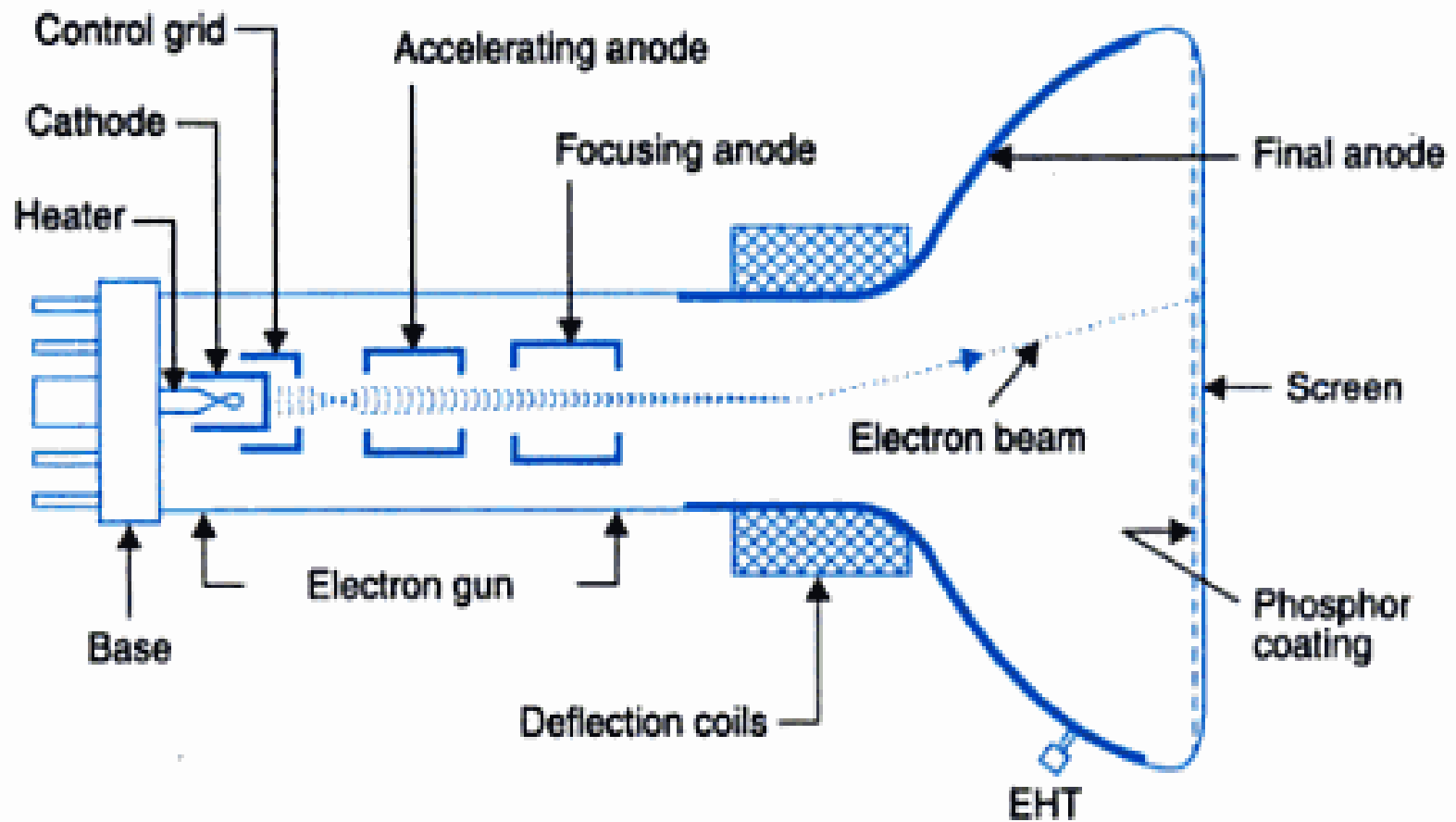


Fig. 1.3 Elements of a picture tube.

- Beam is deflected by a pair of deflecting coils in the same way and rate as the beam scans the target area in the camera tube
- Video signal is fed to the grid or cathode of the picture tube
- When the varying signal voltage makes the control grid less negative, the beam current is increased, making the spot on the screen brighter
- More negative grid voltage reduces brightness

Sound reception

- Sound signals are separated from the picture signals in the video detector section
- Amplified – demodulated (FM detector)
- Fed to audio amplifier and loud speaker

Synchronization

- To ensure perfect synchronization between scene being televised and the picture produced on the raster
- Synchronizing pulses are transmitted during retrace ie flyback intervals
- Distinct for horizontal and vertical motion control
- Radiated along with the picture details
- Processed at the receiver and fed to the picture tube sweep circuitry

Receiver controls

- Channel selector - for selecting desired channel
- Fine tuning control – for obtaining best picture details in the selected channel
- Hold control – to get steady picture in case it rolls up or down
- Brightness control – varies the beam intensity of the picture tube
- Contrast control – gain control of the video amplifier
- Volume and tone control – part of audio amplifier

Colour Television

- **Based on the theory of additive colour mixing : all colours including white can be created by mixing red, green and blue lights**
- **Video signal for red, green and blue information are combined and transmitted along with the brightness(monochrome) signal**
- **At the receiver, the three colour signals are separated and fed to the three electron guns of the colour picture tube**
- **Screen of the picture tube has red, green and blue phosphors arranged in alternate dots**
- **Each gun produces an electron beam to illuminate the three colour phosphors separately on the fluorescent screen**
- **Our eye then integrates the red, green and blue colour information and their luminance to perceive the actual colour and brightness of the picture being televised**