LED Technology

By: KMN

Background

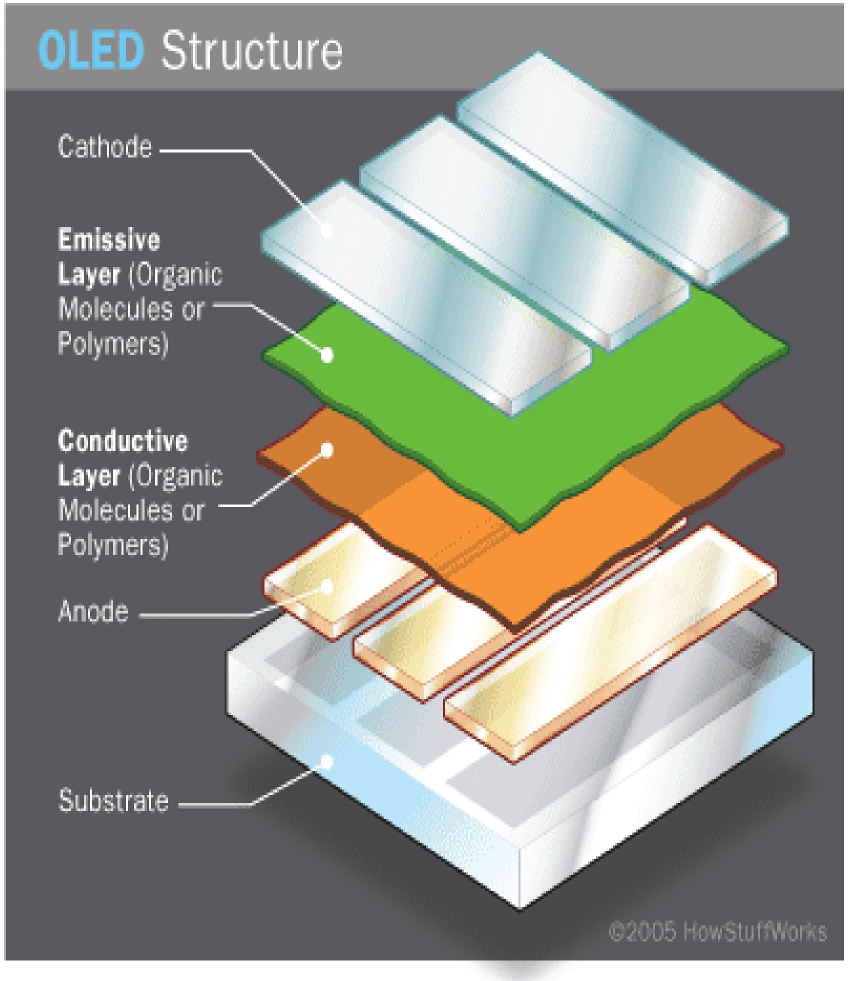
- Organic Light Emitting Diode (OLED)
- Kodak scientist Dr. Ching (1970's)
- OLED materials reported in 1987
- Color improvements by 1989
- Becoming a major competetor with today's LCD/plasma displays

OLED/LED: What’s the diff?

- Both OLED and LED use the same principle of electroluminescence- the optical and electrical phenomenon where certain materials emit light in response to an electric current passing through it.
- OLED
  - Lighter weight
  - Less power consumption
  - Organic based chemicals

How It Works

- Composed of two substrate layers on the outside
- Emissive and conductive layer lie between the cathode and the anode layers
- A current is applied across the LED, where electrons move from cathode to anode
- The cathode gives electrons to the emissive layer, where the anode withdraws these electrons from the conductive layer
- The emissive layer becomes rich in negative charge while the conductive layer becomes more positively charged
- The two charges recombine in the emissive layer, creating a drop in energy levels of the electrons
- The drop in energy levels results in radiation that is on the visible spectrum, emitting light



OLED's Today

- Various Mp3 players
  - Muzio JM-200
  - Sony NW-E015F Walkman
  - Arcos 204
- Kodak's LS633 3mpx digital camera
  - Priced at 399$
  - Good battery life
  - 2.2" OLED screen

Continued…

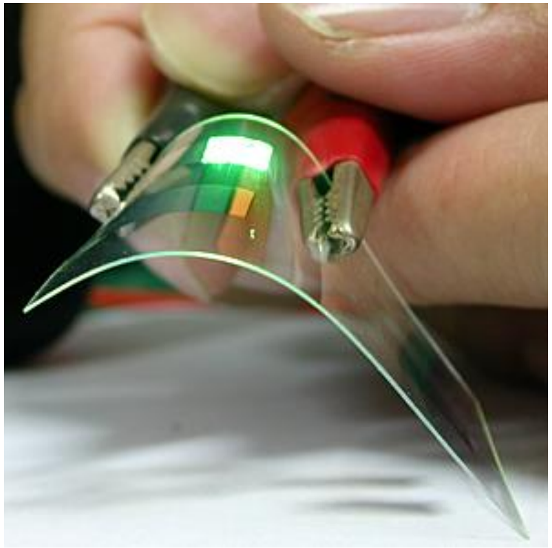
- Mobile devices
  - Apple iPhone

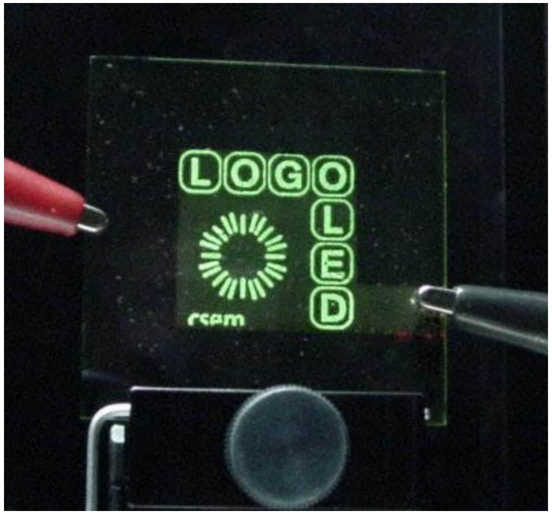
  - Sony Ericsson W51S

OLED vs. Plasma/LCD

- Advantages
  - Brighter, clearer picture
  - More efficient viewing angle
  - Thinner, lighter in weight
  - Low powered
  - Can be printed on various surfaces

…continued





- Disadvantages
  - Short term battery life
  - Expensive

Why so Expensive?

- Uses ink-jet printing technology

- Sprays conductive polymer substances, instead of ink.

Future Developments

- Smaller sized OLED TV's

- Middle-larger sized flexible semiconductor technology

Companies

- Samsungs
  - 12mm thick
  - 1600x1200 aspect ratio
- Sony intends to give OLED technology making OLED TV’s.
- Toshiba and other

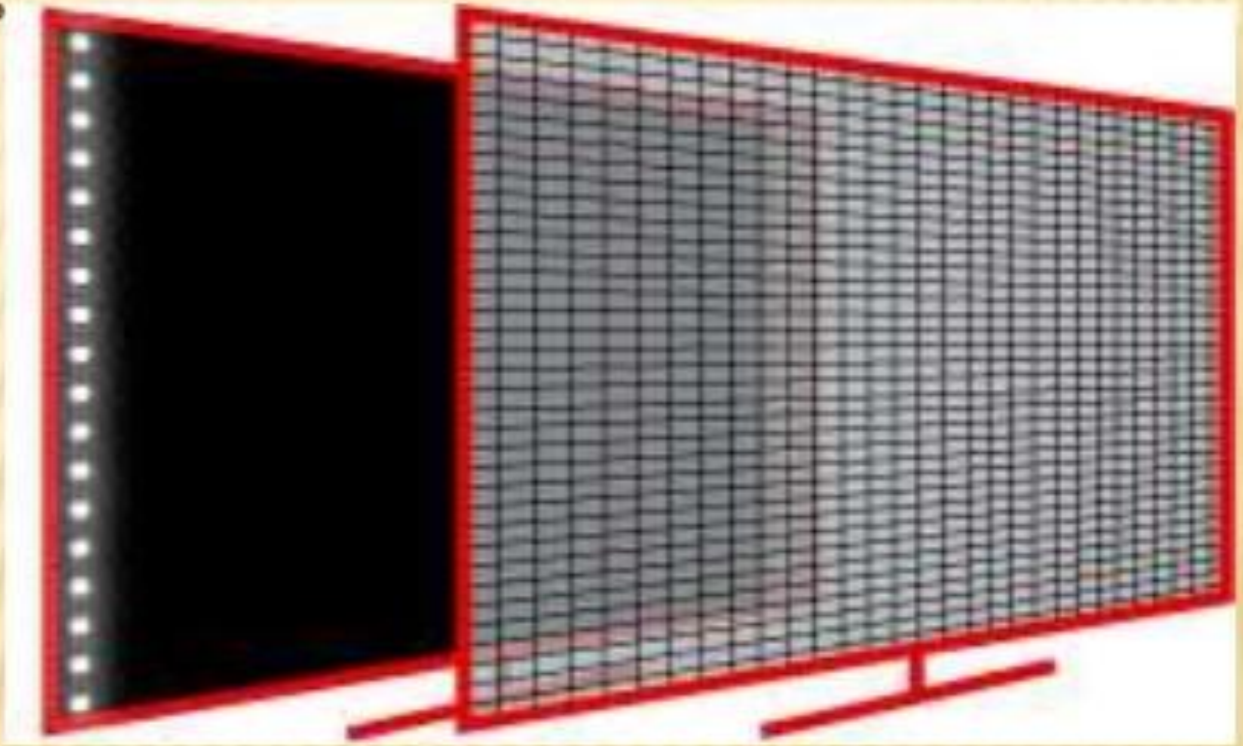
LED vs LCD

- The difference in lights and in lighting placement has generally meant that LED TVs can be thinner than LCDs, although this is starting to change.
- It has also meant that LED TVs run with greater energy efficiency and can provide a clearer, better picture than the general LCD TVs.
- Because of difference in lights and lightning placement there are two types

- EDGE LIT
- FULL ARRAY LIT

EDGE LIT

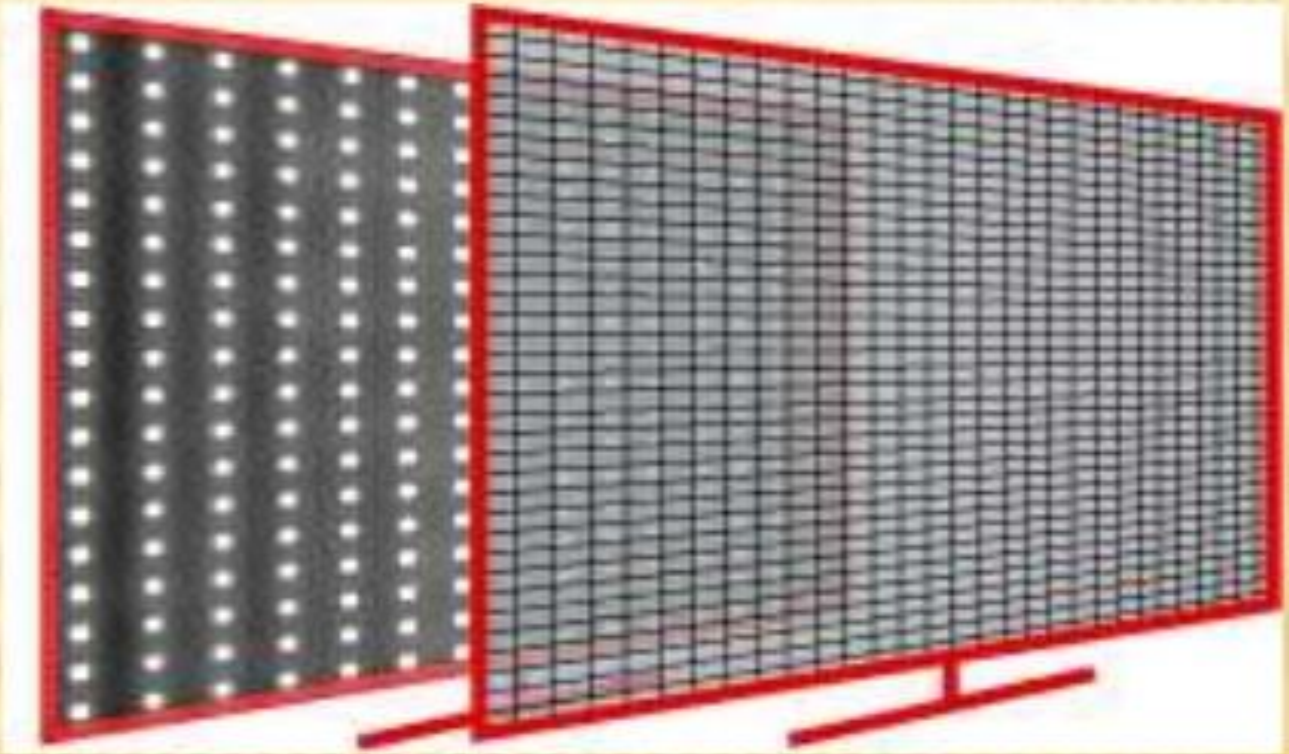
- This is the most common method for LED TVs



EDGE LIT

- In an edge lit LED screen, the LEDs are placed at the peripheral of the screen.
- Depending on the television, it can be all around the screen or only on the sides or the bottom.
- This allows the screen to be very thin. However, it can cause some spots on the screen to be brighter than others, like the edges.

FULL ARRAY



FULL ARRAY

- This method is considered the best LED backlight type, but can only be found on a very limited number of models.
- In a full array LED screen, the LEDs are distributed evenly behind the entire screen. This produces a more uniform backlight and it provides a more effective use of local dimming, where it can change the luminosity of only a specific part of the screen.

SPECIFICTION

- Cost : As per size of TV(almost 20k -70k)
- Size : available in 32”,42”,…….

- As per the market survey LG, SAMSUNG, SONY,TOSHIBA,PANASONIC are making LED TV.

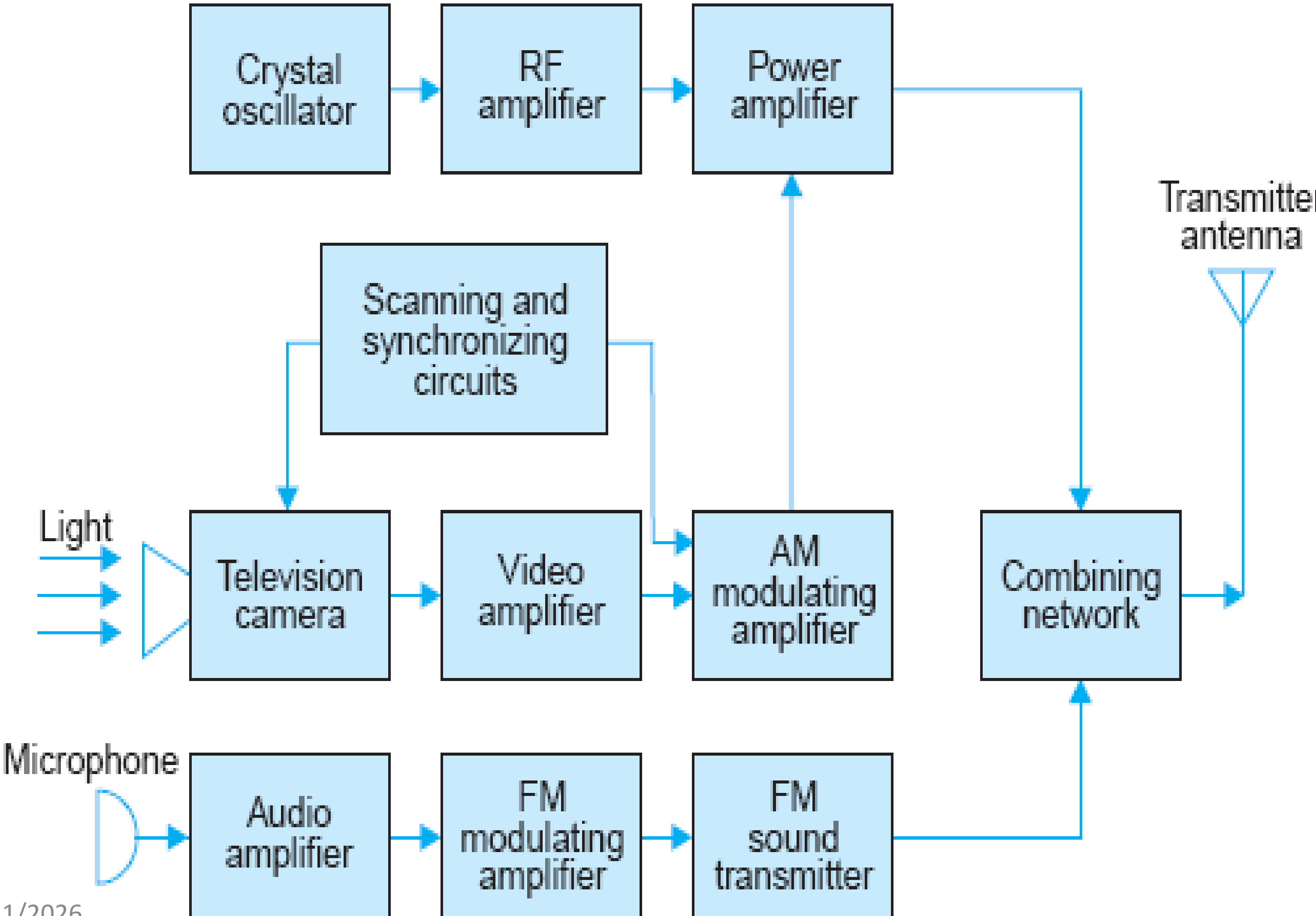
THANK YOU

TELEVISION

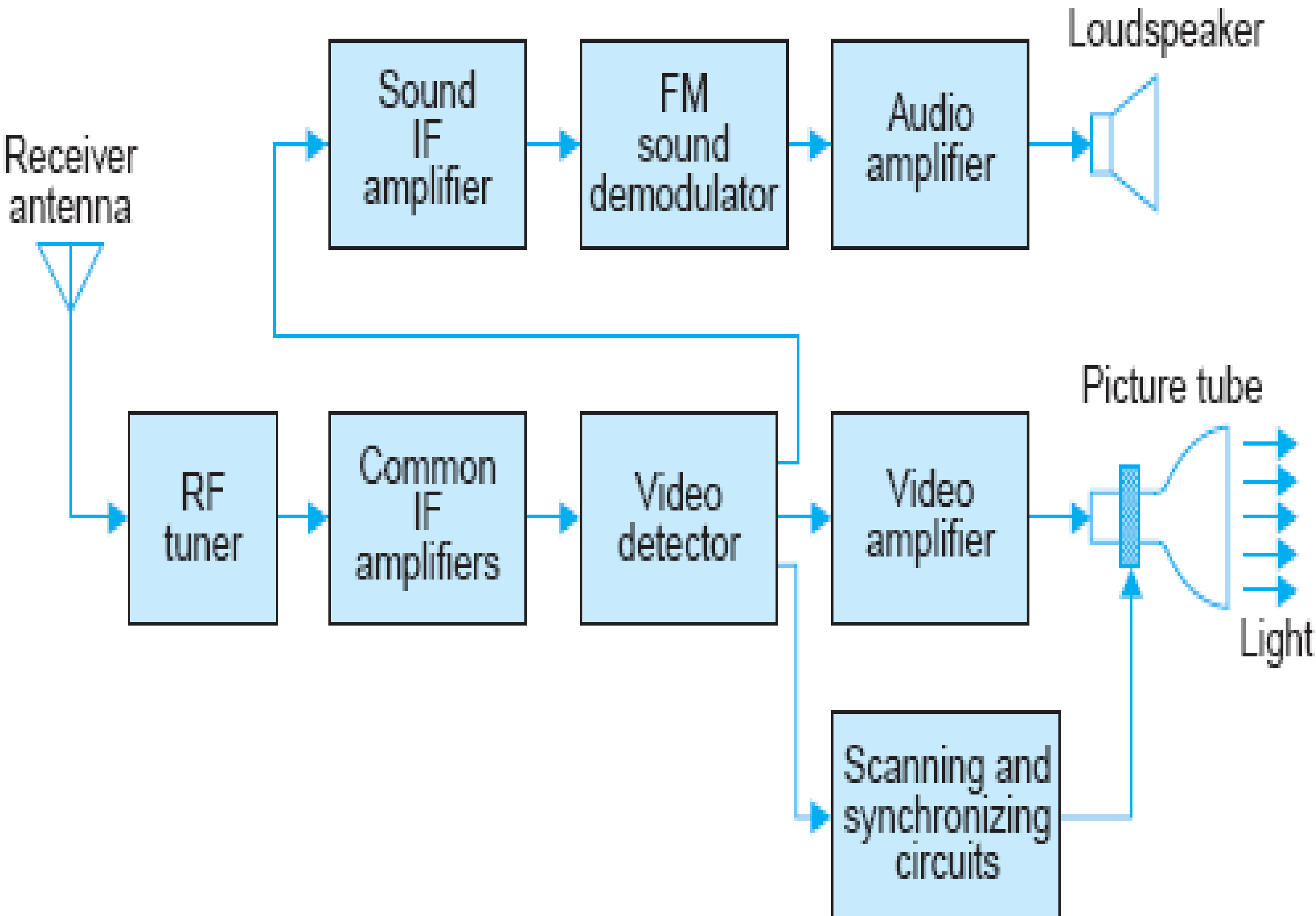
Elements of a T V System

- Picture Transmission
- Sound Transmission
- Picture Reception
- Sound Reception
- Synchronization
- Receiver Controls
- Colour Television.

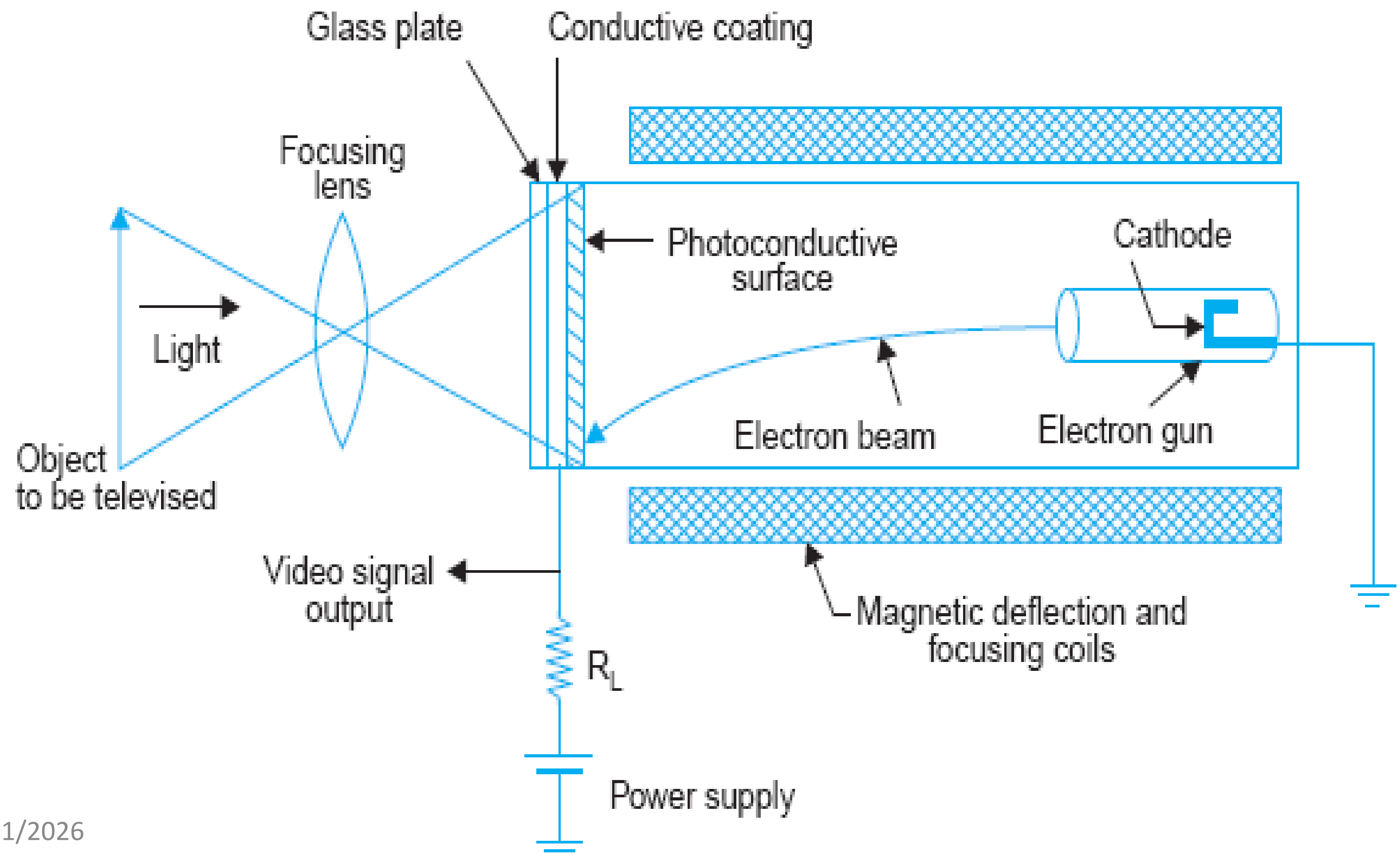
Basic monochrome television transmitter



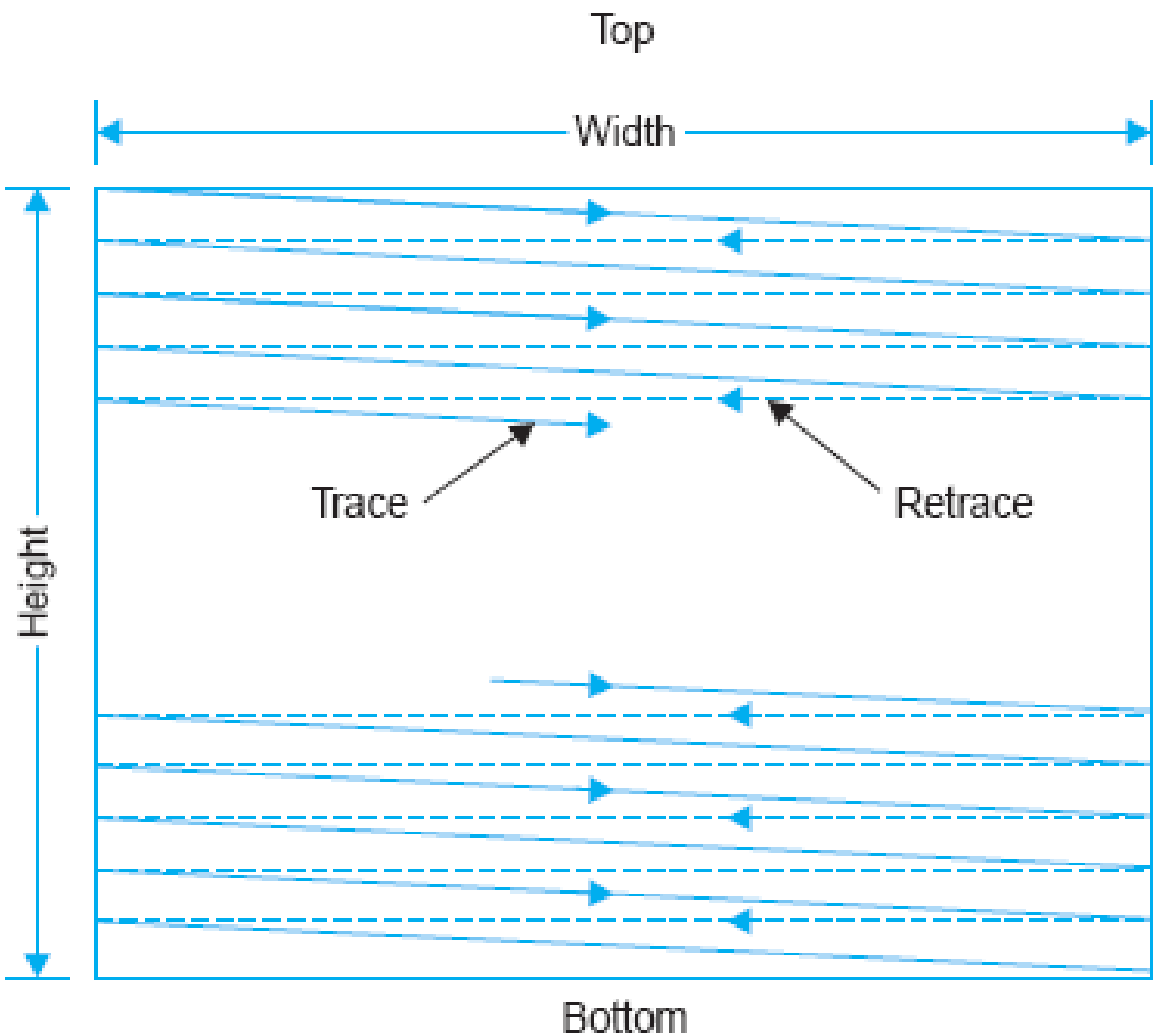
Basic monochrome television receiver



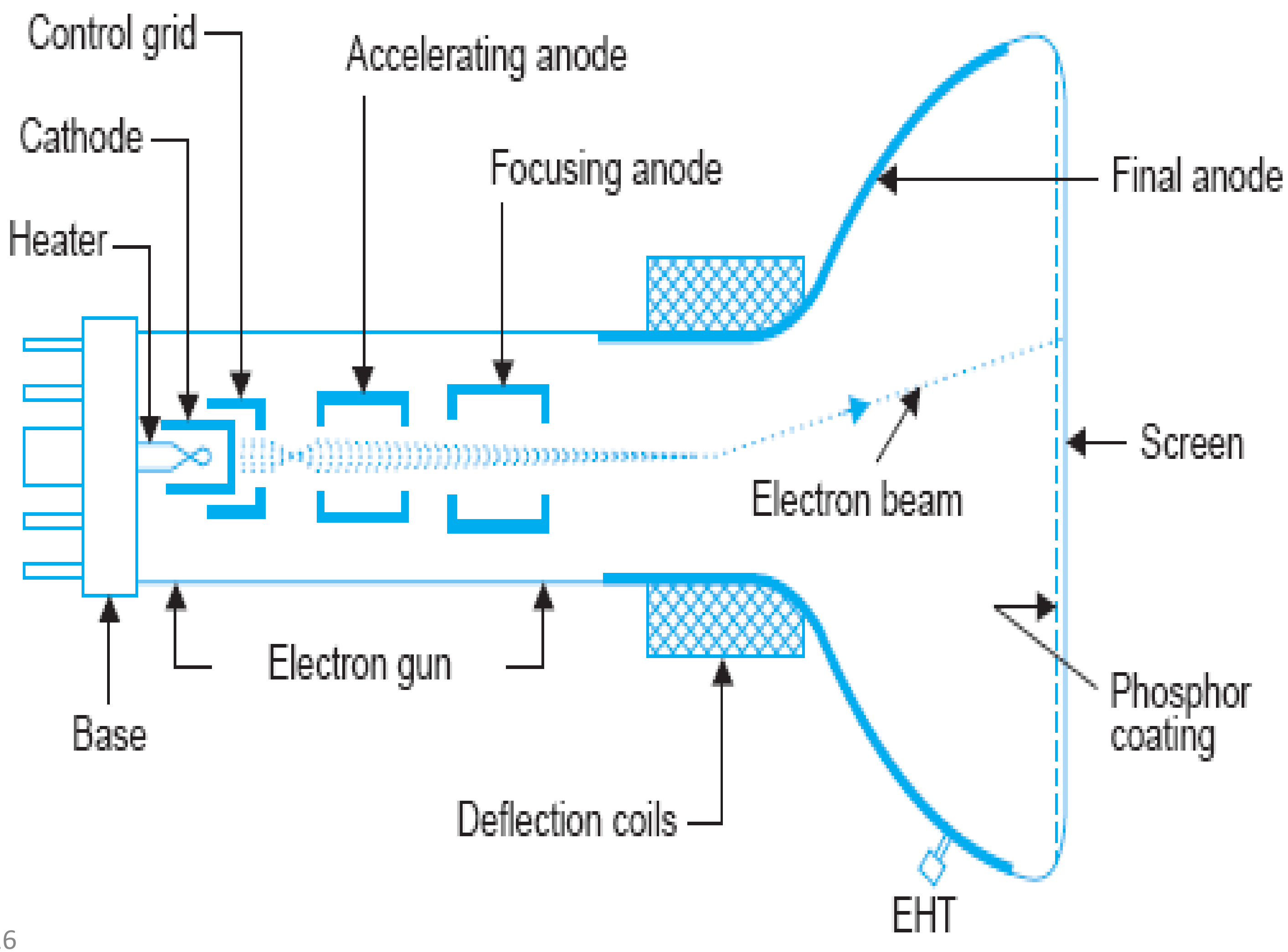
Simplified cross-sectional view of a Vidicon TV camera tube



Path of scanning beam in covering picture area

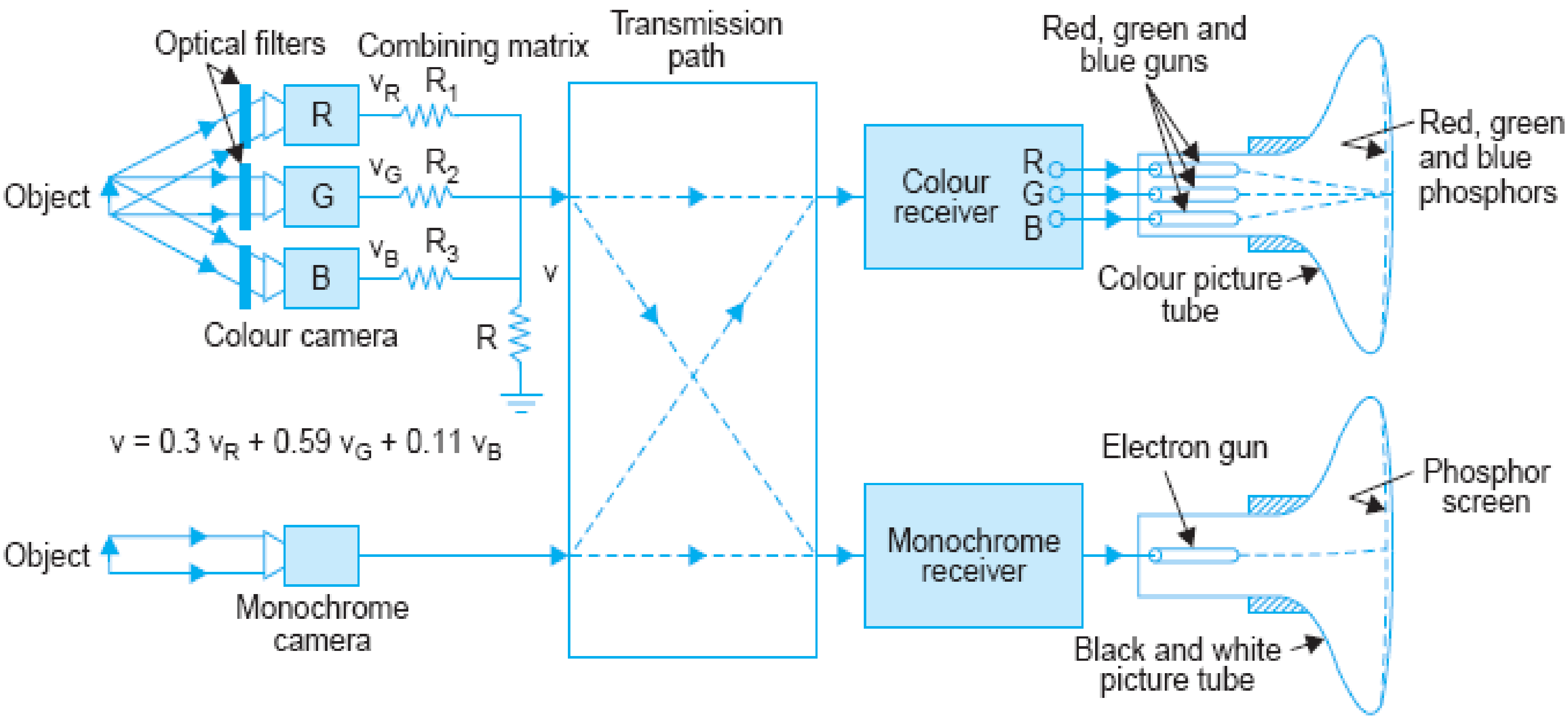


Elements of a picture tube



Signal transmission paths illustrating compatibility between colour and monochrome TV systems.

R, G and B represent three camera tubes which develop video signals corresponding to the red, green and blue contents of the scene being televised



Television System

NTSC Standard

(National Television Standards Committee)

- **Standard for U.S., Japan, and Korea**
- **4 X 3 Aspect Ratio**
- **525 Lines**
- **30 Frames Per Second**
- **Scanned in "Fields"**

PAL System
(Phase Alternating Line)

- Another World Television Standard
- 4 X 3 Aspect Ratio
- 625 Lines
- 25 Frames Per Second
- Scanned in "Fields"
- There are Slight Variations: PAL-B, -G, -H, -N
- Used in Continental Europe and Parts of Africa, Middle East & So. America
- More Lines = Better Resolution
- Fewer Frames/Fields = More "Flicker"

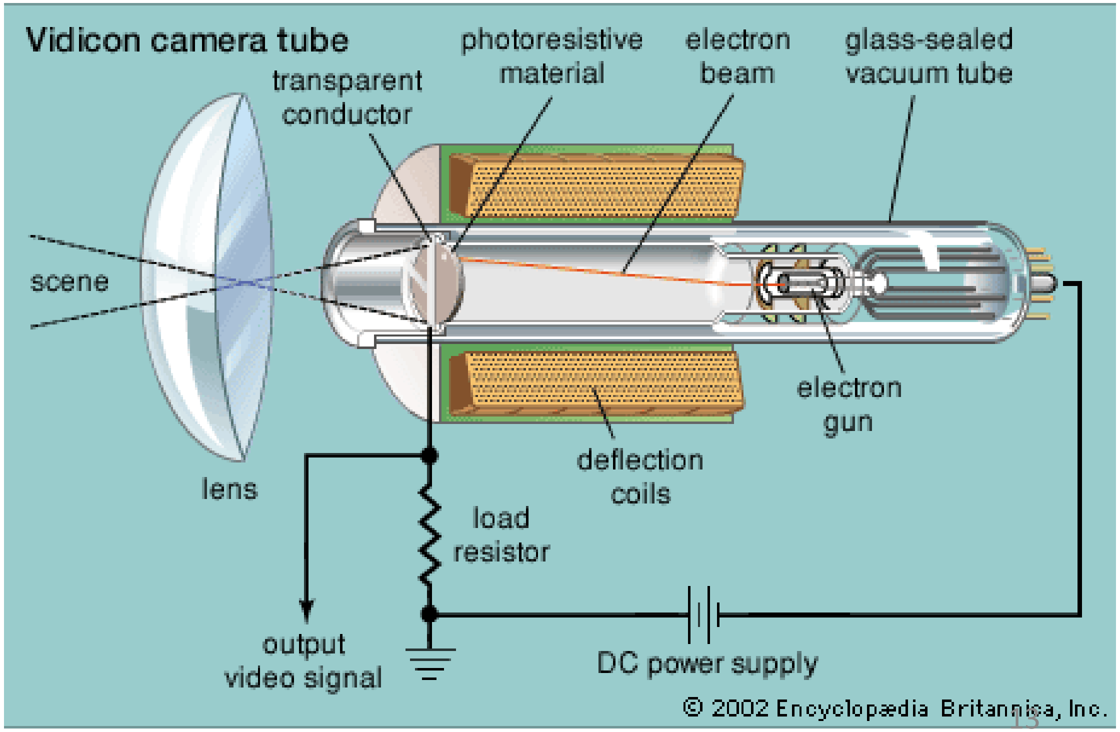
SECAM System
(Sequential Color and Memory)

- Another World Television Standard
- 4 X 3 Aspect Ratio
- 625 Lines
- 25 Frames Per Second
- Scanned in "Fields“
- Used in France, Eastern Europe and Parts of the Middle East & Africa
- More Lines = Better Resolution
- Fewer Frames/Fields = More "Flicker"

HDTV System (High Definition Television)

- 16 X 9 Aspect Ratio
- A **Digital** System
- Permits Several Levels of Picture Resolution Similar to that of High-Quality Computer Monitors, With 720 or 1080 Lines (1280 x 720 pixels or 1920 x 1080 pixels)
- Ranges from 24 to 60 frames per second, progressive or interlaced scan
- Uses MPEG-2 Compression to squeeze a 19 megabit-per-second data flow so that it can be accommodated by a standard broadcast TV channel of 6 MHz bandwidth
- 5.1 Channels of Dolby AC-3 Digital Surround-Sound Audio

Vidicon TV Pick-up Tube

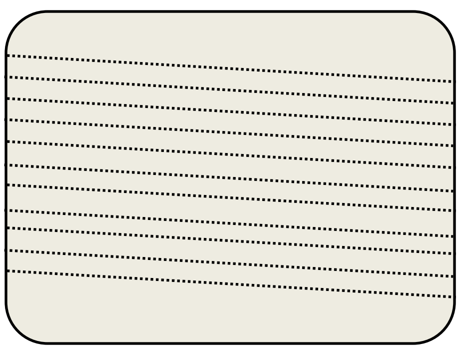


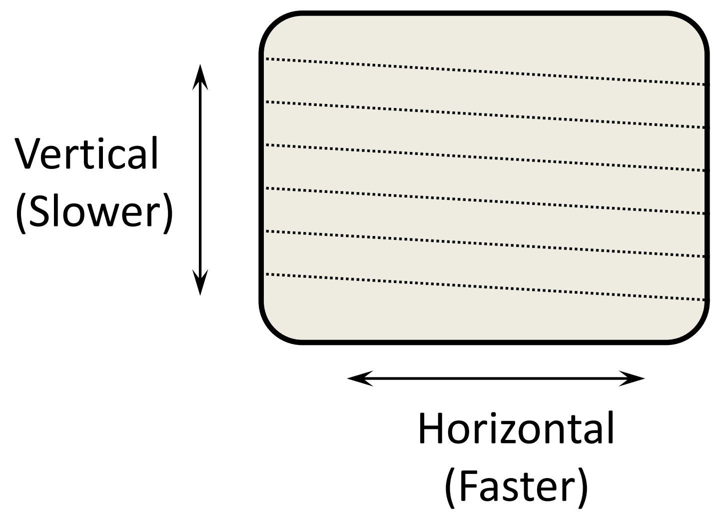
Basic Factors

- Structure (Aspect ratio – 4:3)
- Continuity (25 FPS)
- Scanning lines (860 x 0.7)
- Flicker (Interlaced Scanning)
- Resolution (Vertical & Horizontal)
- Other factors.

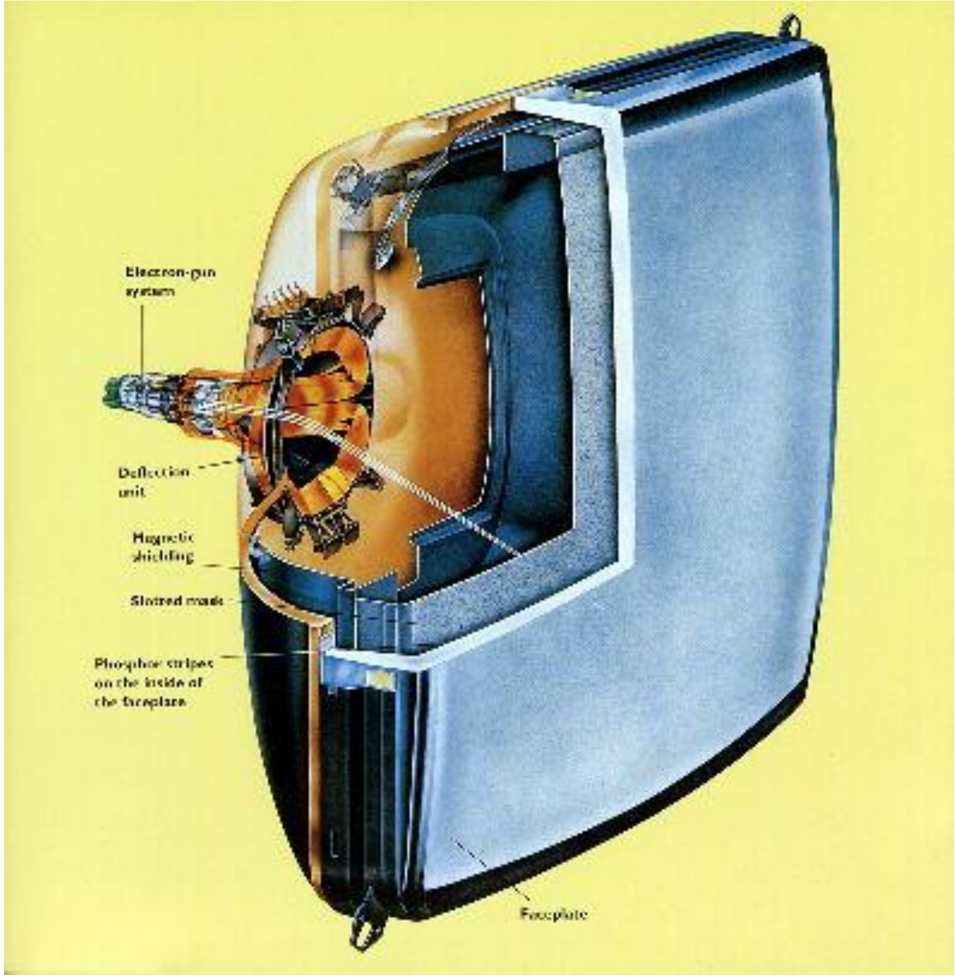
Television Scanning

- beam scanning for standard TV
  - 625 lines in total image
  - 25 images (**frames**) scanned per second
- Oscillators
  - Vertical
  - Horizontal

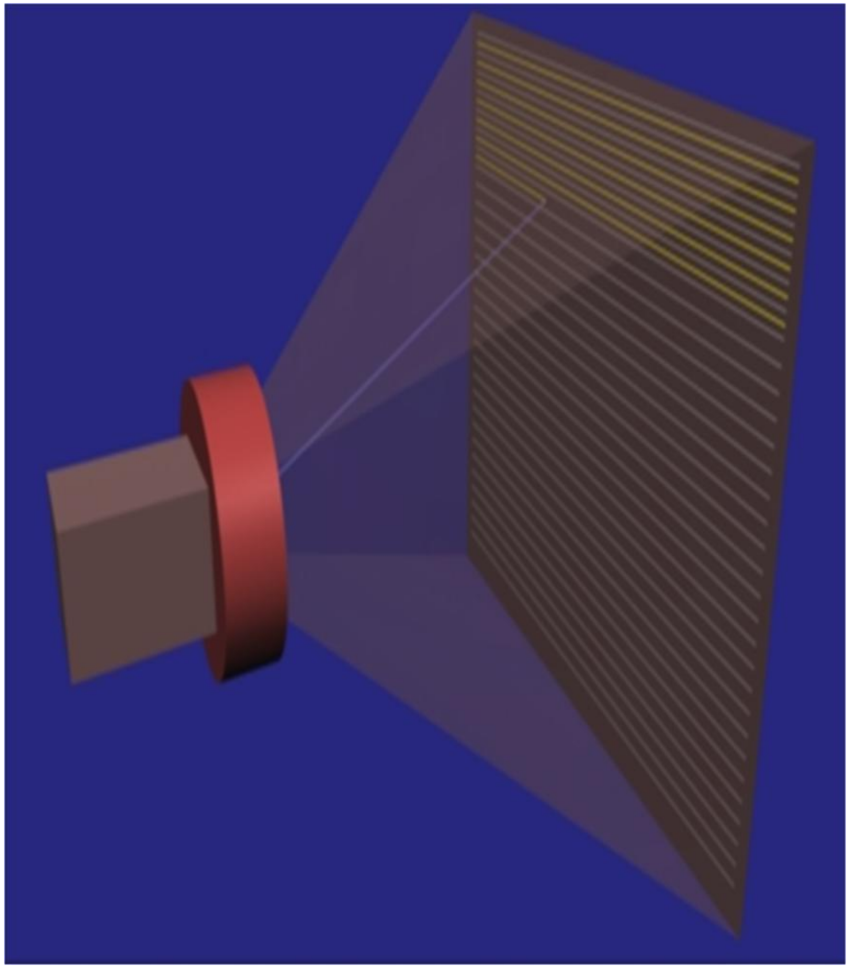




CRT

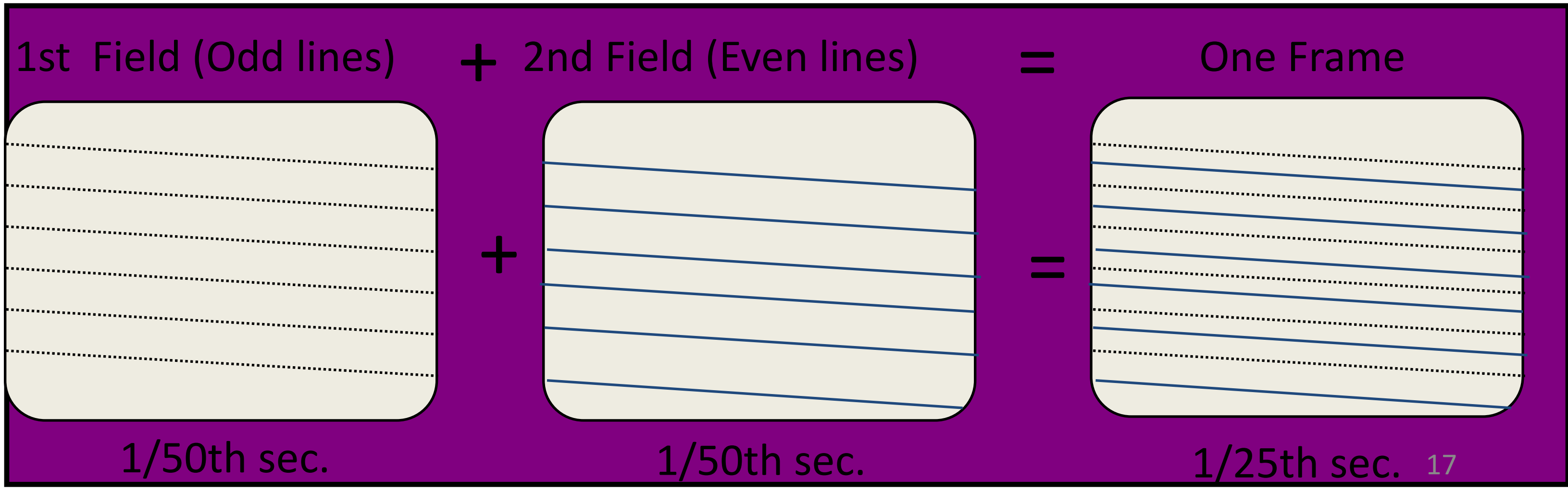


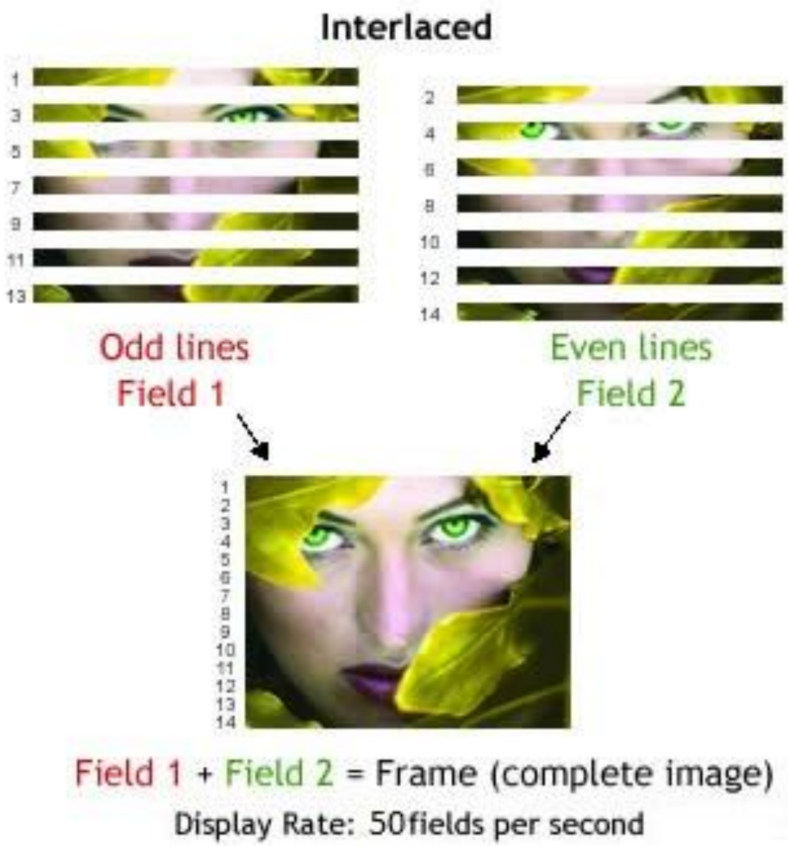
Electron-gun system
Deflection unit
Magnetic shielding
Slotted mask
Phosphor stripes on the inside of the faceplate
Faceplate



TV Interlacing

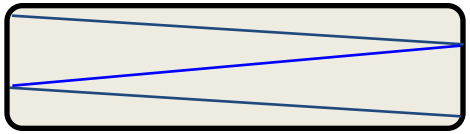
- **frame** scanned in two passes, first the odd lines then the even
  - One frame takes 1/25th second
  - avoids flicker
- each pass called a **field**
  - takes 1/50th second



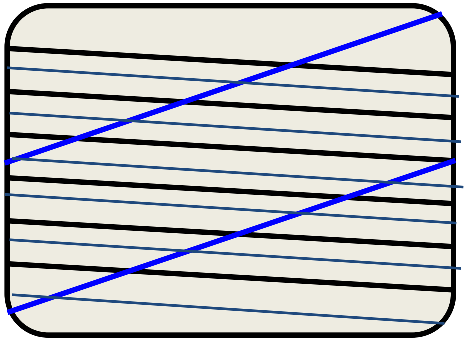

Interlaced
1
3
5
7
9
11
13
2
4
6
8
10
12
14
Odd lines
Field 1
Even lines
Field 2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Field 1 + Field 2 = Frame (complete image)
Display Rate: 50fields per second

Synchronization

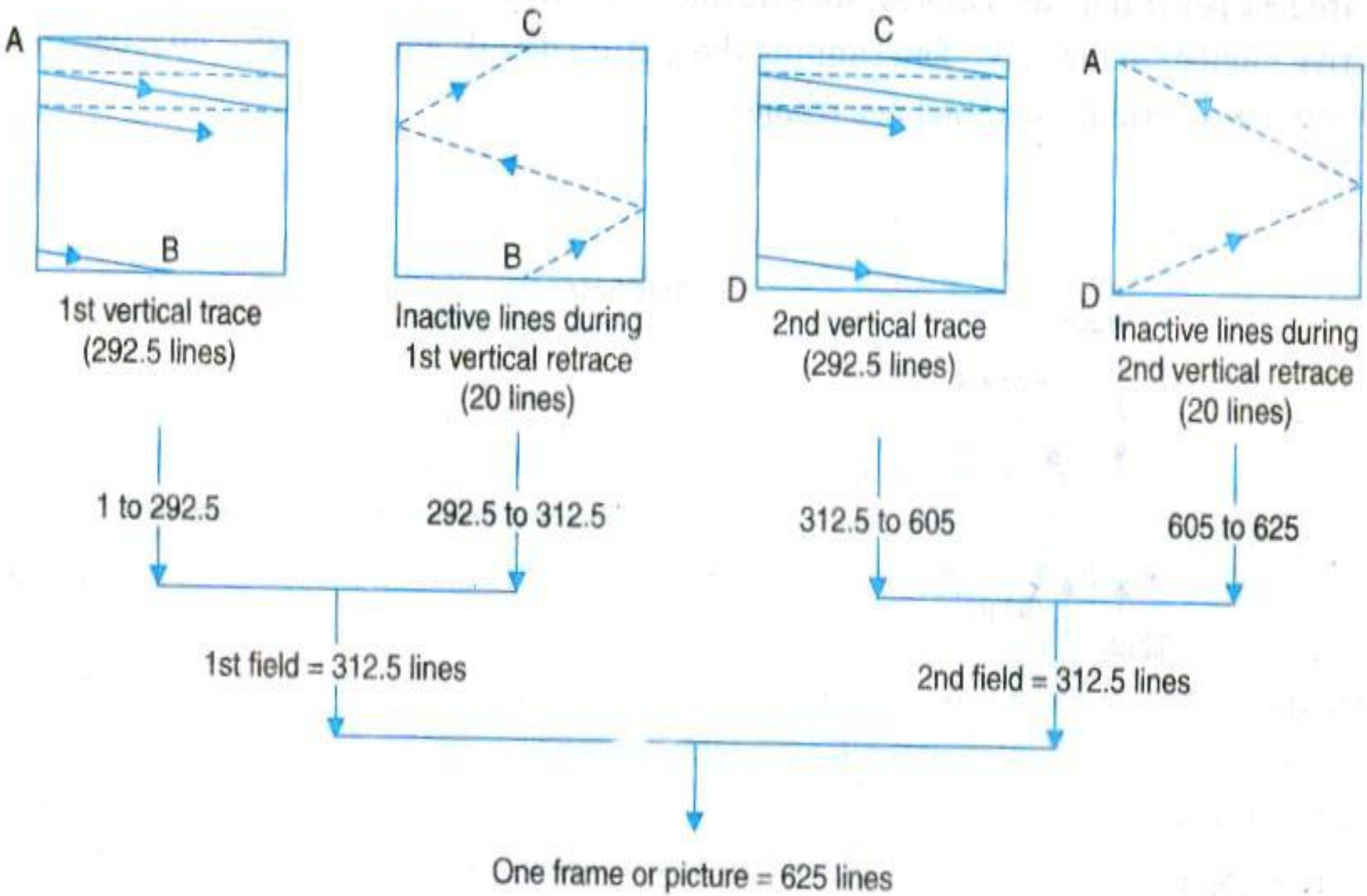
- TV Camera & Monitor must be synchronized
  – beam at same place on image
- special sync pulses sent at end of each horizontal line & vertical field
- retrace
  – horizontal retrace
    - beam returned to left side of screen
  – vertical retrace
    - beam returned to the top of screen
  – Turns off video during retrace

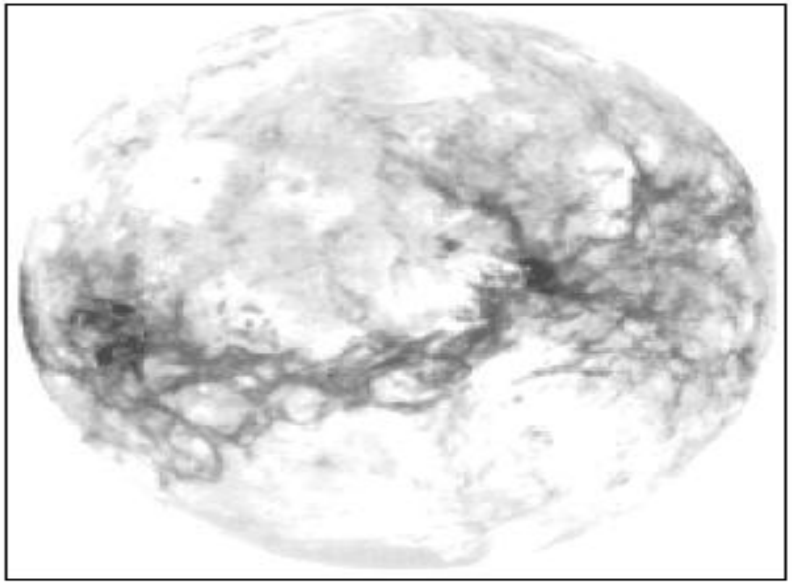


Horizontal Retrace

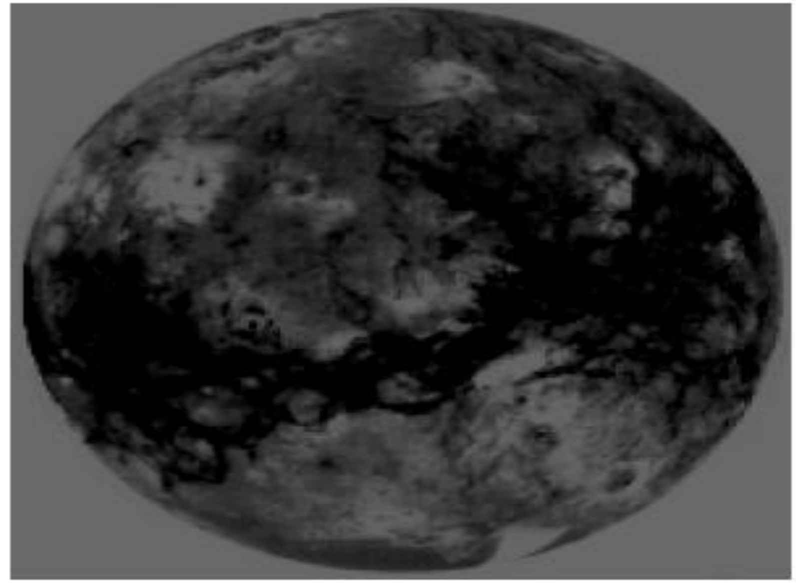


Vertical Retrace

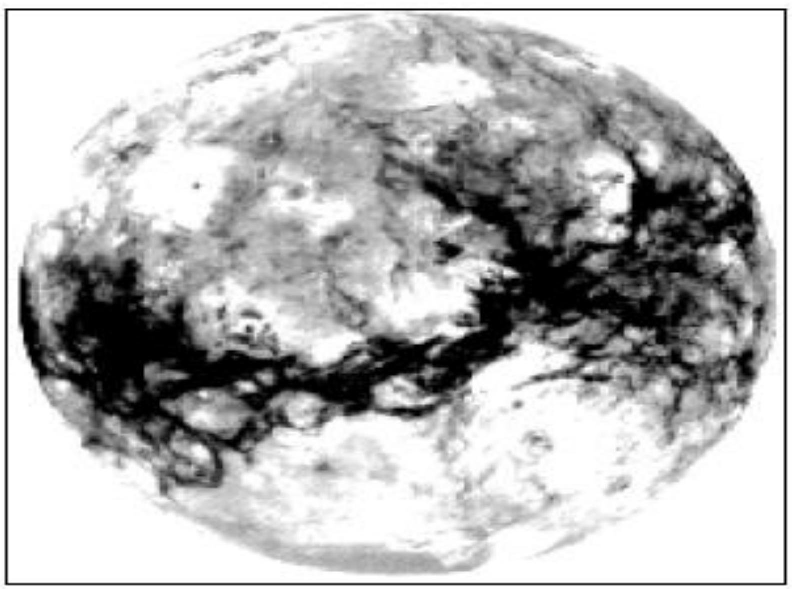

A
B
C
B
C
D
A
D
1st vertical trace
(292.5 lines)
Inactive lines during
1st vertical retrace
(20 lines)
2nd vertical trace
(292.5 lines)
Inactive lines during
2nd vertical retrace
(20 lines)
1 to 292.5
292.5 to 312.5
312.5 to 605
605 to 625
1st field = 312.5 lines
2nd field = 312.5 lines
One frame or picture = 625 lines



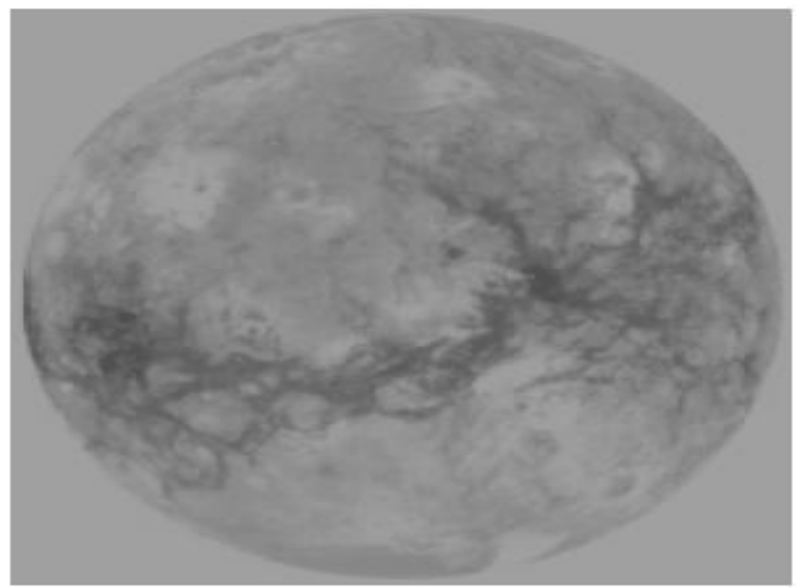
Brightness too high



Brightness too low

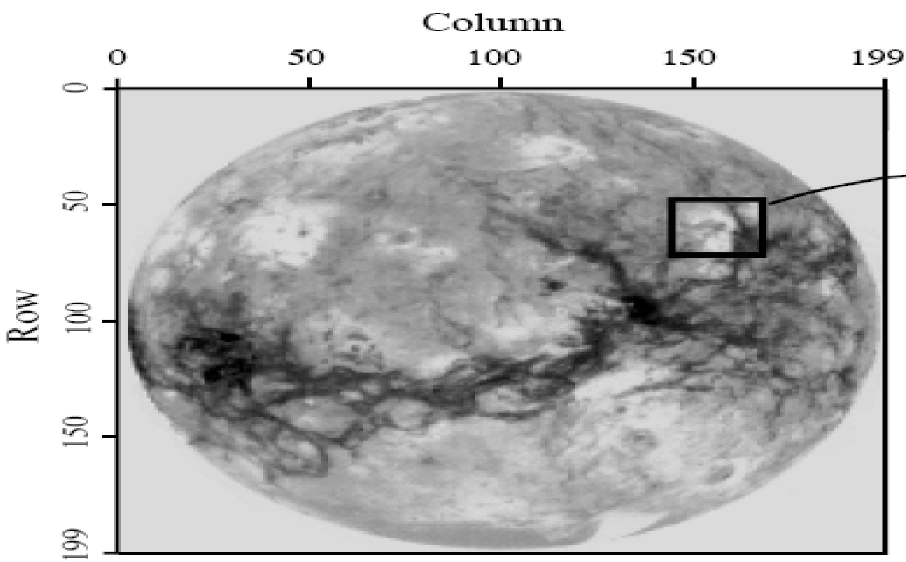


Contrast too high



Contrast too low

Brightness and contrast adjustments. Increasing the *brightness* makes every pixel in the image becomes lighter. In comparison, increasing the *contrast* makes the light areas become lighter, and the dark areas become darker. These images show the effect of misadjusting the brightness and contrast.



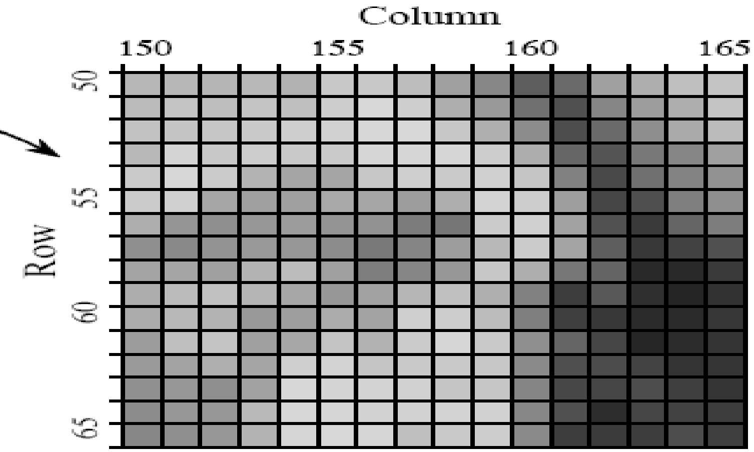


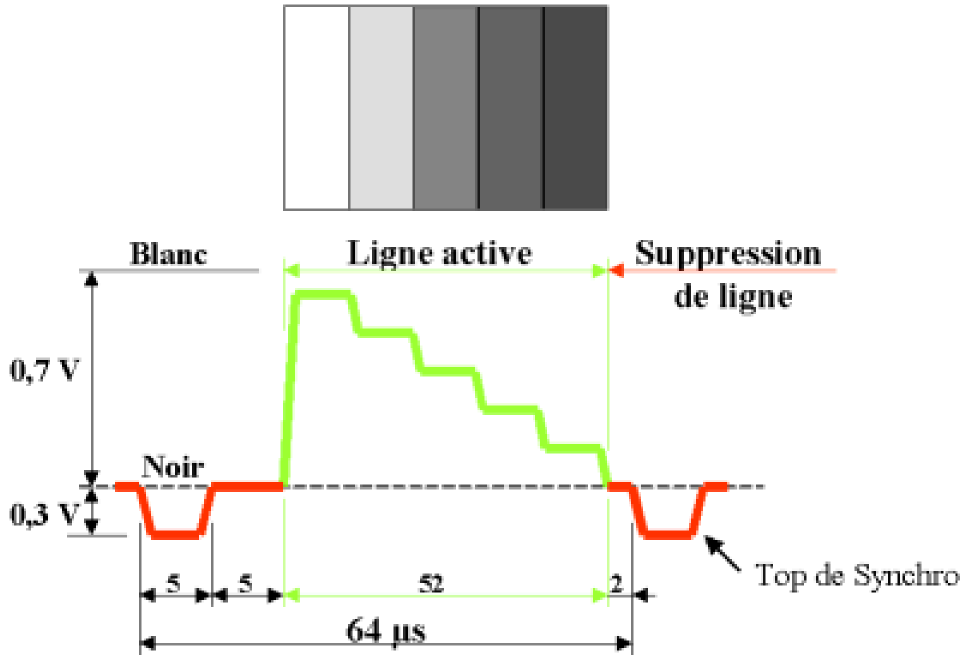
Image Formation and Display

Digital image structure. This example image is the planet Venus, as viewed in reflected microwaves. Digital images are represented by a two-dimensional array of numbers, each called a *pixel*. In this image, the array is 200 rows by 200 columns, with each pixel a number between 0 to 255. When this image was acquired, the value of each pixel corresponded to the level of reflected microwave energy. A *grayscale* image is formed by assigning each of the 0 to 255 values to varying shades of gray.

Column

Row	150					155					160					165
50	183	183	181	184	177	200	200	189	159	135	94	105	160	174	191	196
	186	195	190	195	191	205	216	206	174	153	112	80	134	157	174	196
	194	196	198	201	206	209	215	216	199	175	140	77	106	142	170	186
	184	212	200	204	201	202	214	214	214	205	173	102	84	120	134	159
	202	215	203	179	165	165	199	207	202	208	197	129	73	112	131	146
55	203	208	166	159	160	168	166	157	174	211	204	158	69	79	127	143
	174	149	143	151	156	148	146	123	118	203	208	162	81	58	101	125
	143	137	147	153	150	140	121	133	157	184	203	164	94	56	66	80
	164	165	159	179	188	159	126	134	150	199	174	119	100	41	41	58
	173	187	193	181	167	151	162	182	192	175	129	60	88	47	37	50
60	172	184	179	153	158	172	163	207	205	188	127	63	56	43	42	55
	156	191	196	159	167	195	178	203	214	201	143	101	69	38	44	52
	154	163	175	165	207	211	197	201	201	199	138	79	76	67	51	53
	144	150	143	162	215	212	211	209	197	198	133	71	69	77	63	53
	140	151	150	185	215	214	210	210	211	209	135	80	45	69	66	60
65	135	143	151	179	213	216	214	191	201	205	138	61	59	61	77	63

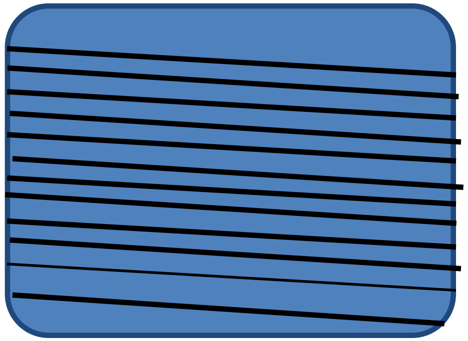
Video Signal



- Voltage level indicates brightness
- Blanking during non-video
  - retrace

Vertical Resolution

- proportional to # of vertical scan lines
- theoretic maximum
  - half # of visible scan lines
  - black lines alternate with white
    - max. line pairs = video lines / 2



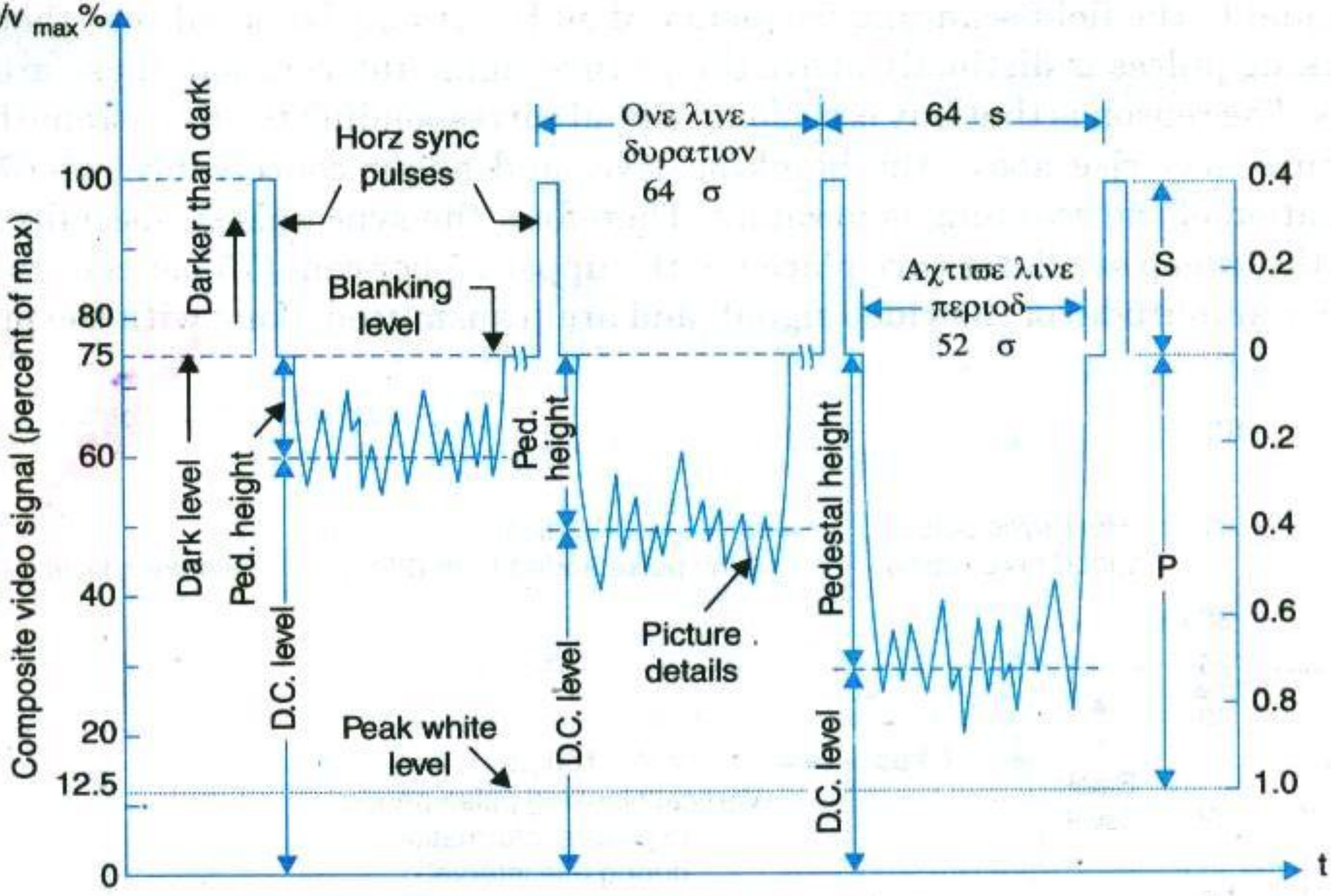


Fig. 3.1 Arbitrary picture signal details of three scanning lines with different average brightness levels. Note that picture to sync ratio P/S = 10/4.

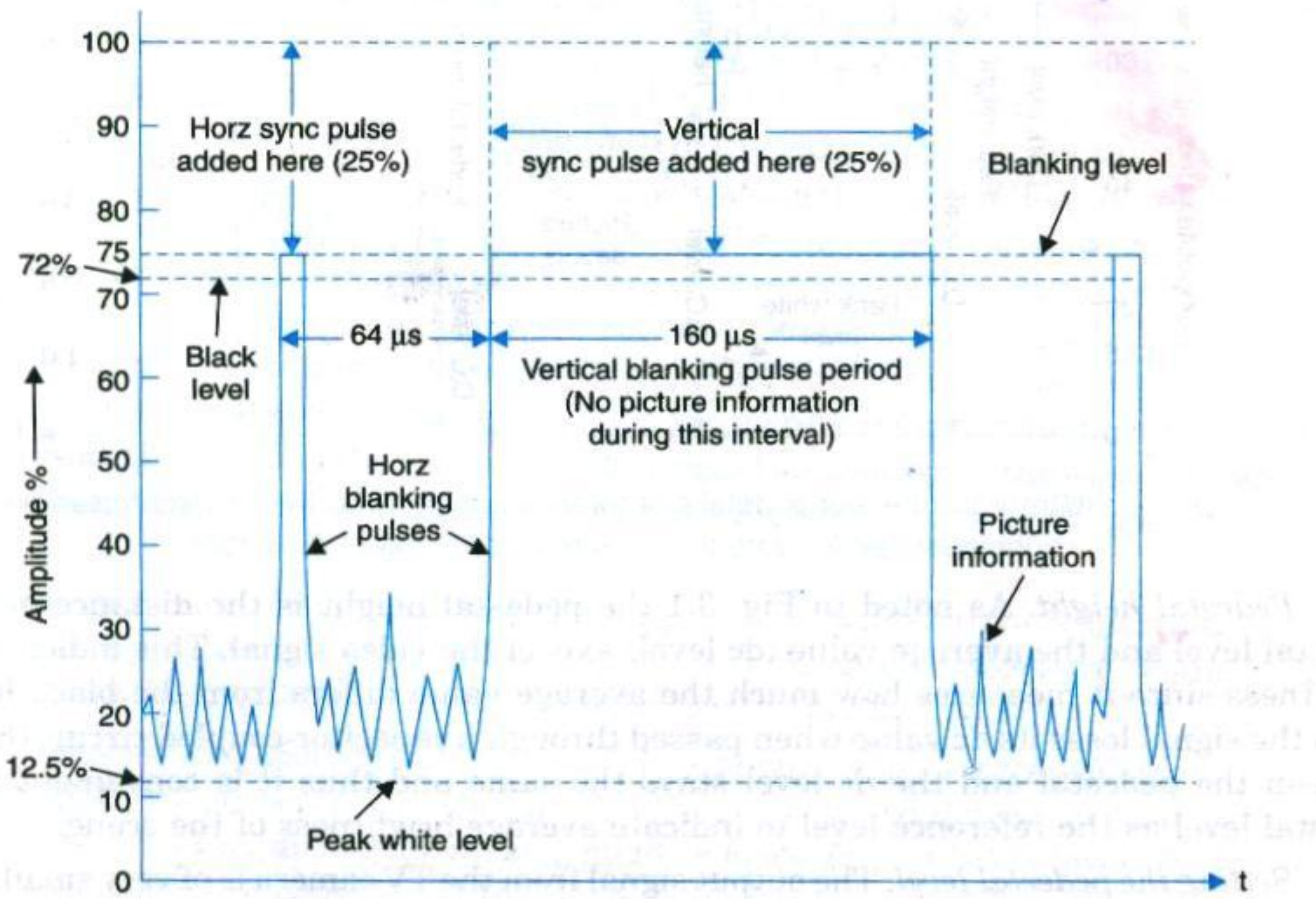


Fig. 3.2 Horizontal and vertical blanking pulses in video signal. Sync pulses are added above the blanking level and occupy upper 25% of the composite video signal amplitude.

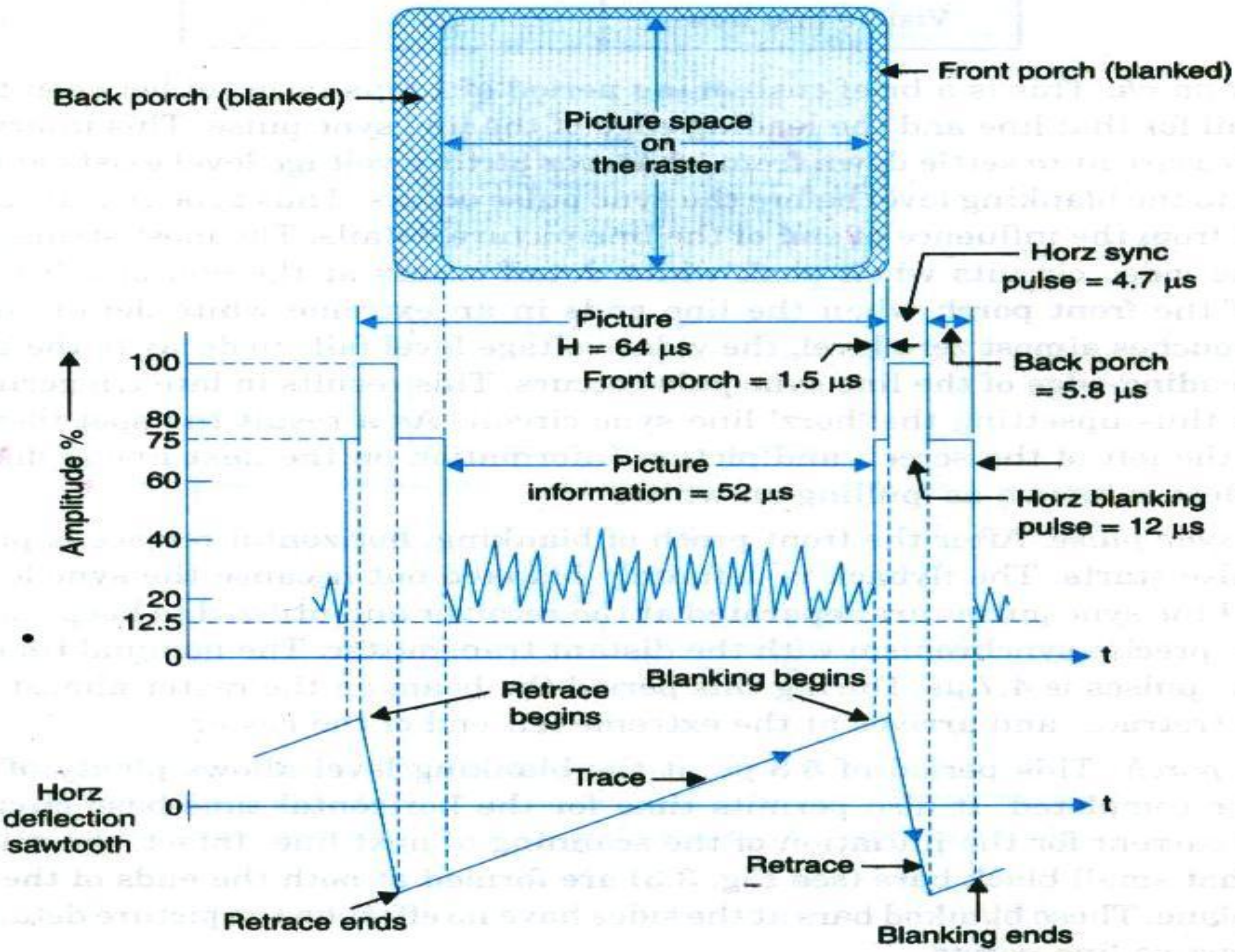


Fig. 3.3 Horz line and sync details compared to horizontal deflection sawtooth and picture space on the raster.

Details of Horizontal Scanning

Period	*Time* (μs)
Total line (*H*)	64
Horz blanking	12 ± .3
Horz sync pulse	4.7 ± 0.2
Front porch	1.5 ± .3
Back porch	5.8 ± .3
Visible line time	52

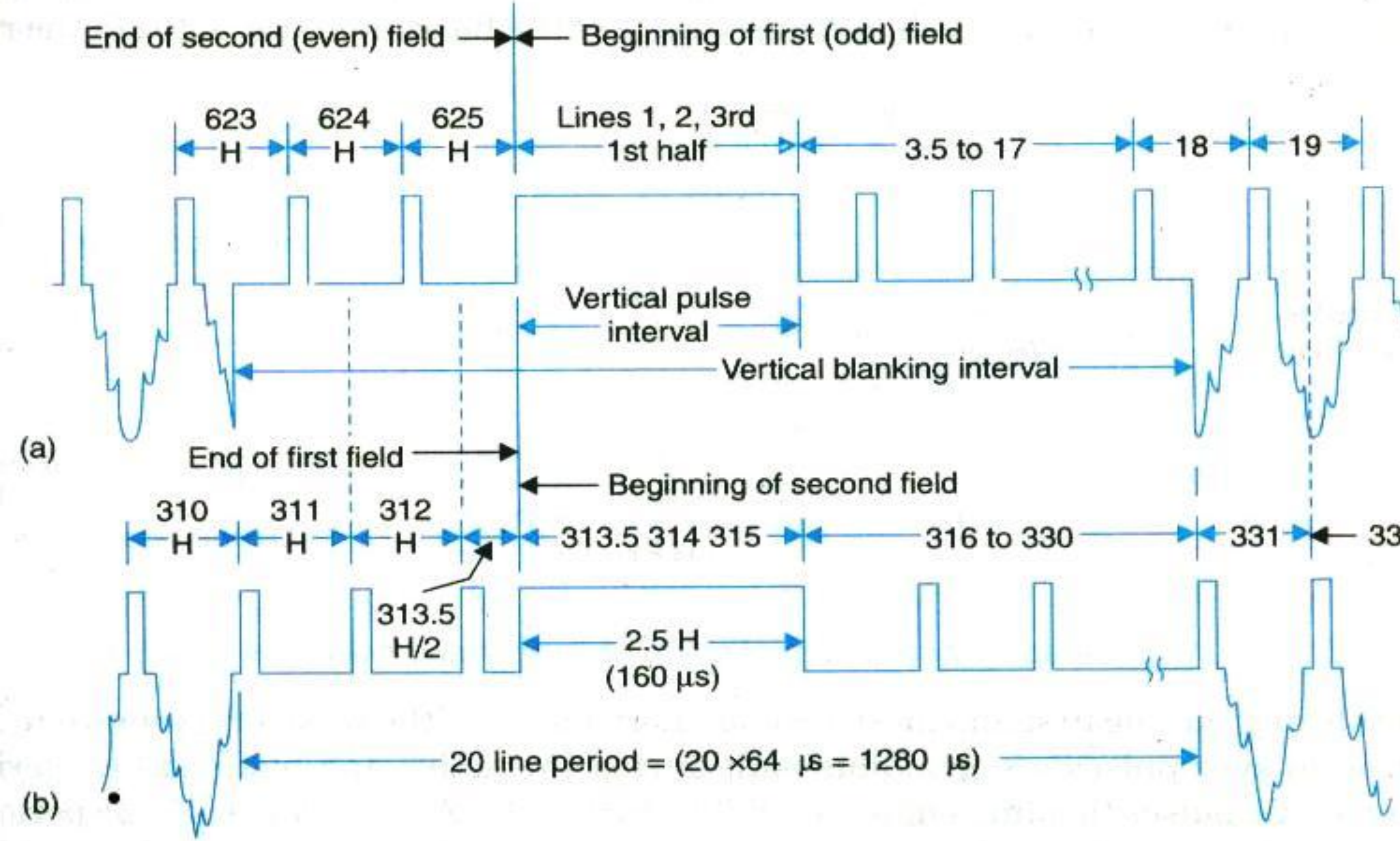


Fig. 3.4 Composite video waveforms showing horizontal and basic vertical sync pulses at the end of (a) second (even) field, (b) first (odd) field. Note, the widths of horizontal blanking intervals and sync pulses are exaggerated.

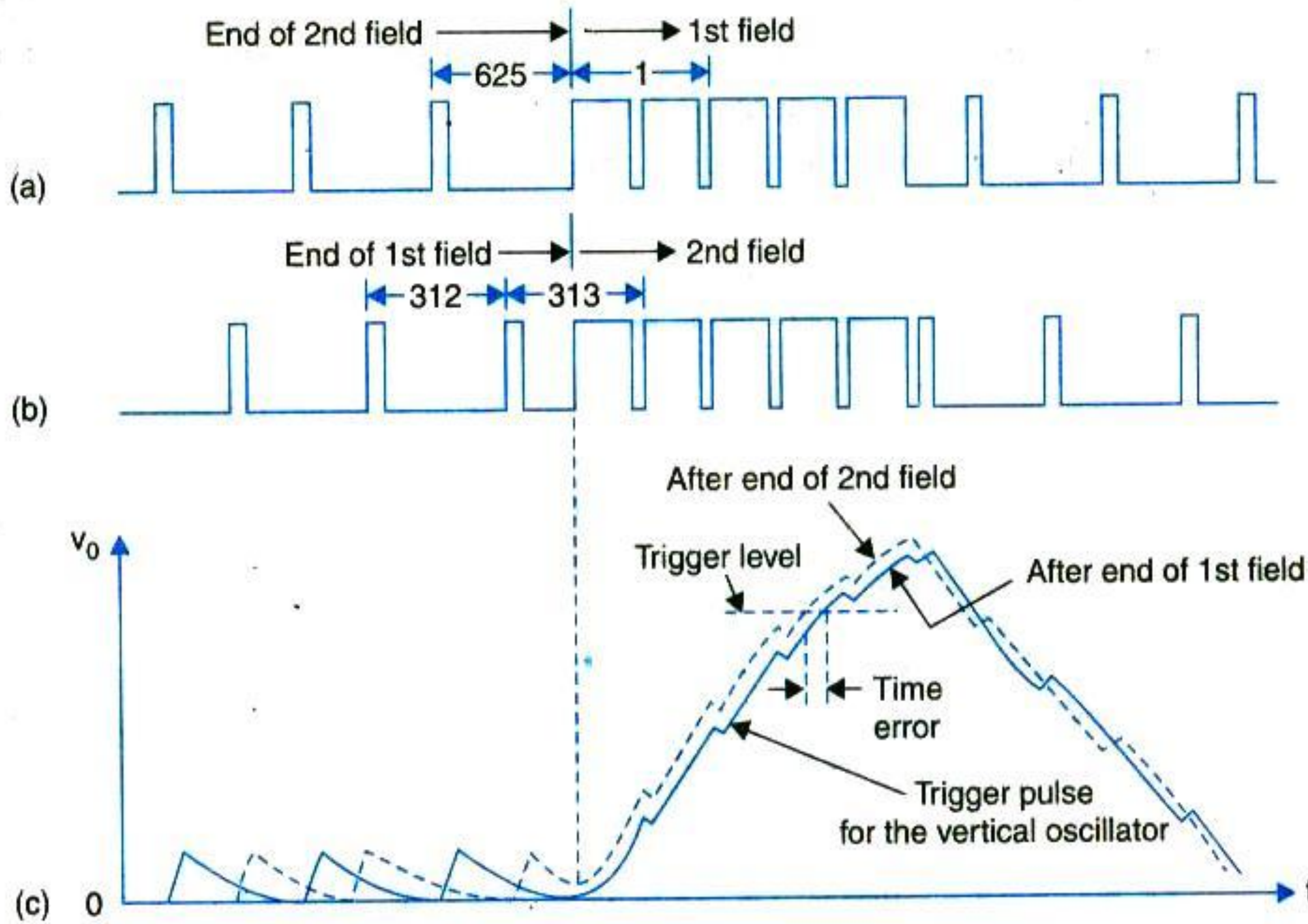


Fig. 3.7 Integrating waveforms (a) pulses at the end of 2nd (even) field (b) pulses at the end of 1st (odd) field (c) integrator output. Note the above sync pulses have purposely been drawn without equalizing pulses.

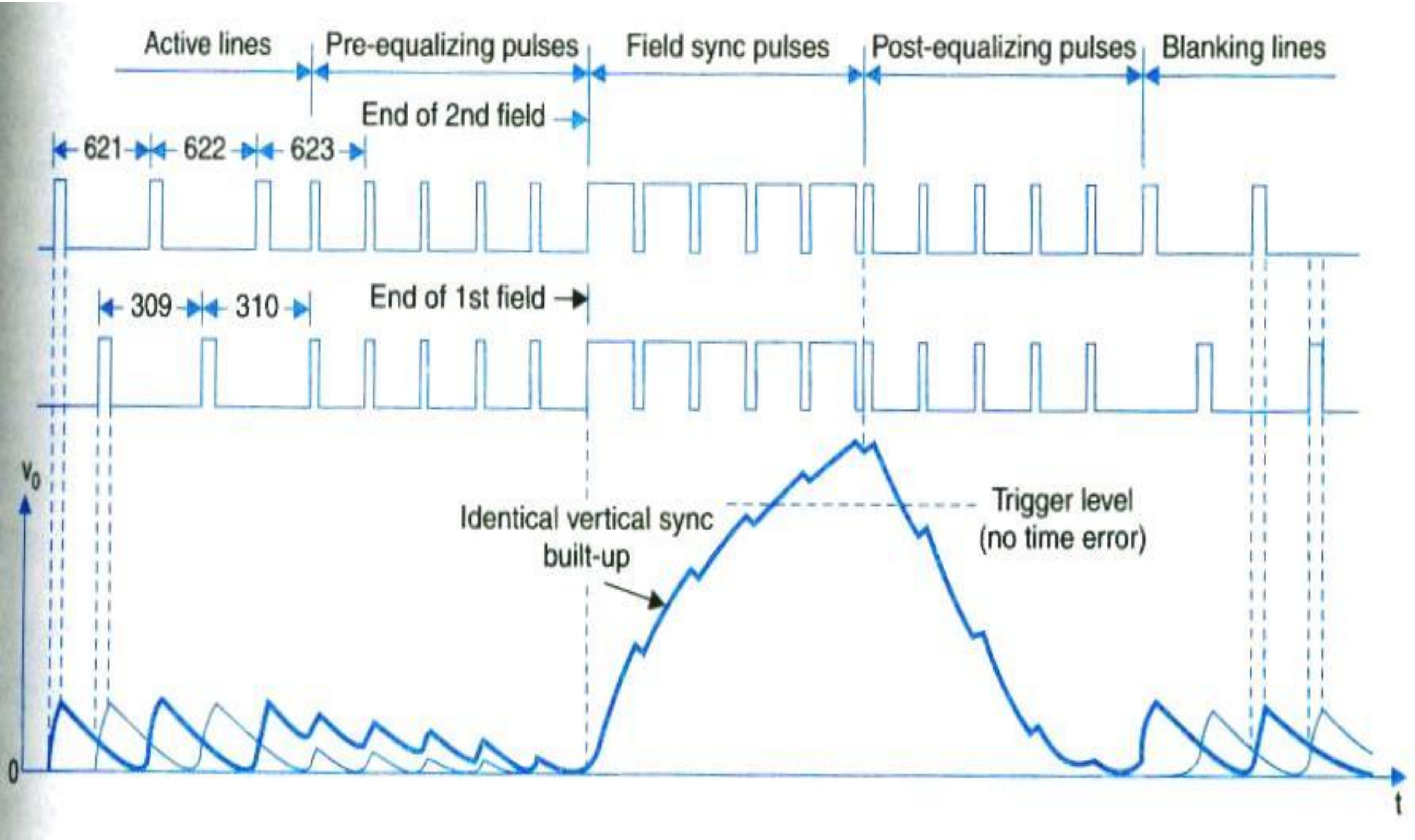


Fig. 3.9 Identical vertical sync voltage built-up across the integrating capacitor.

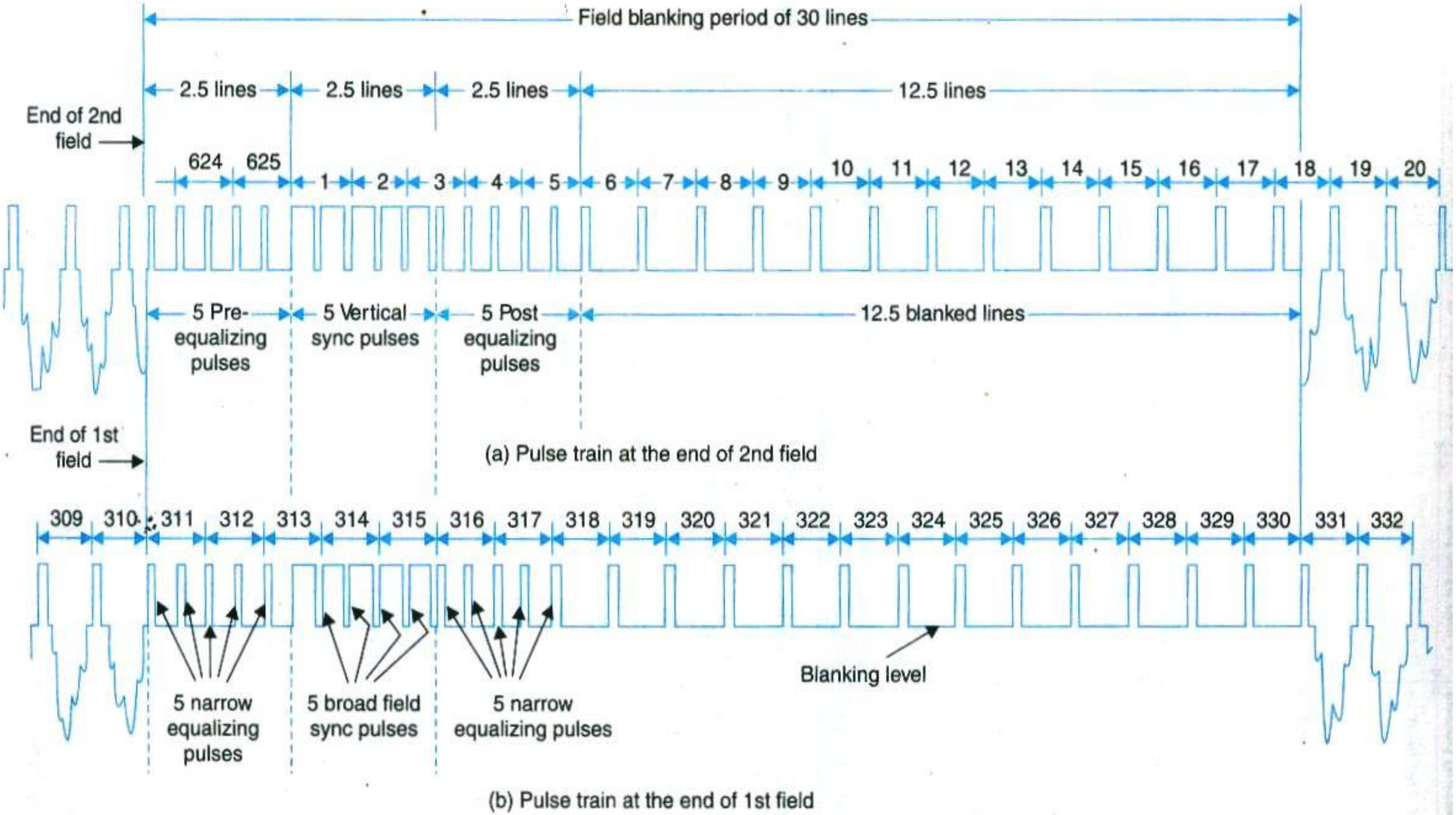


Fig. 3.10 Field synchronizing pulse trains of the 625 lines TV system.

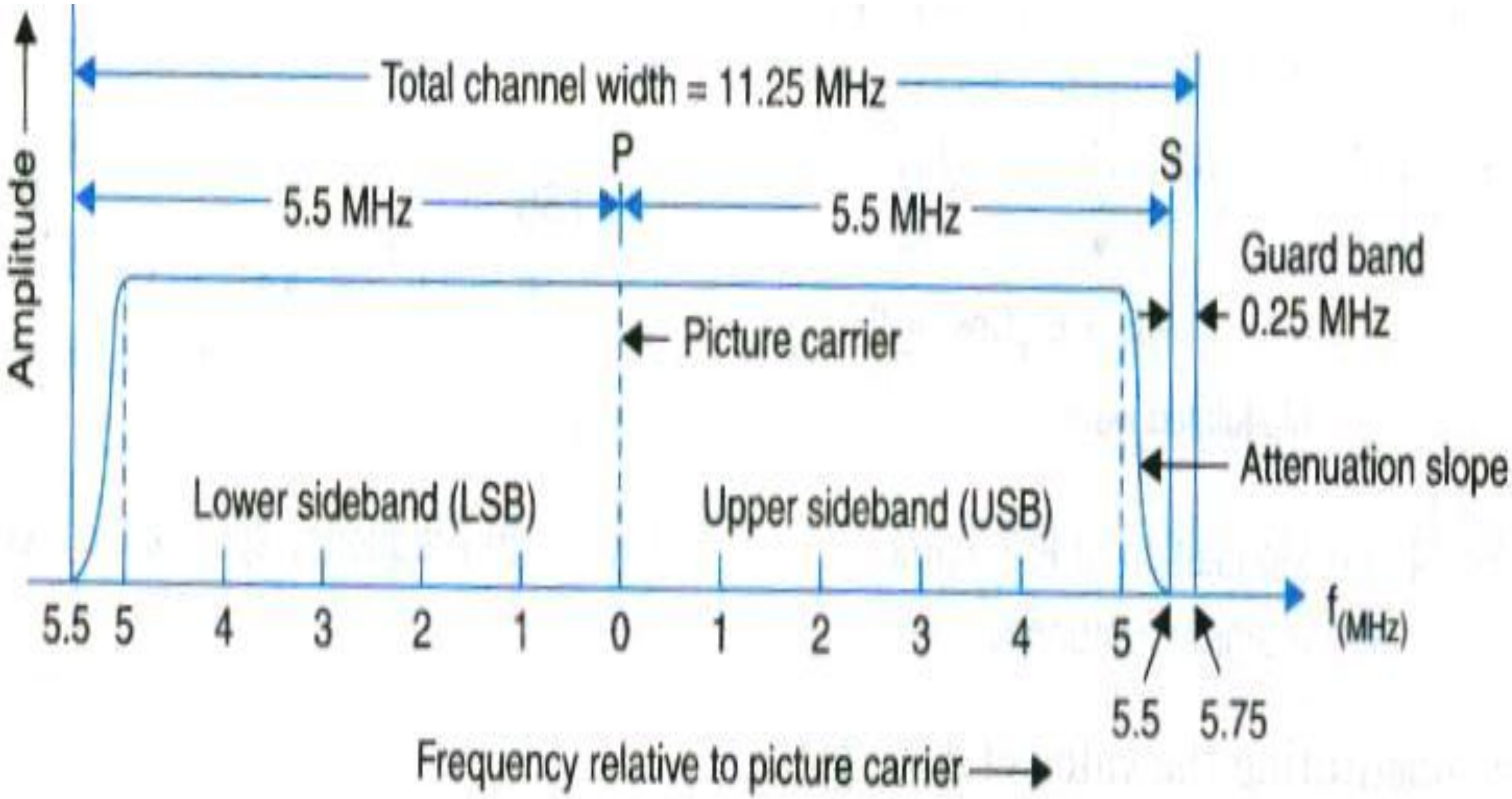


Fig. 4.2 Total channel bandwidth using double sideband picture signal.
P is picture carrier and S is sound carrier.

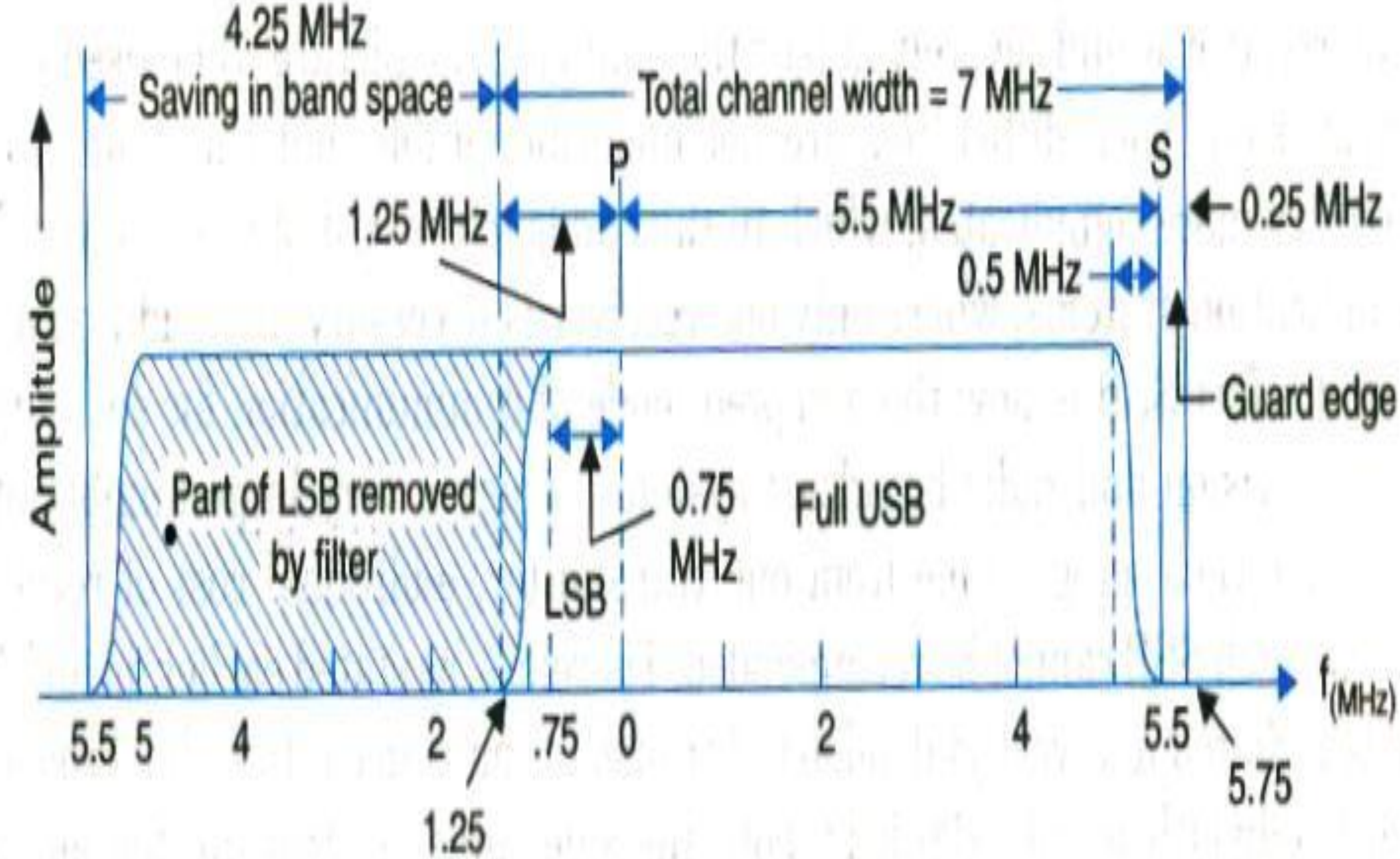


Fig. 4.3 Total channel bandwidth using vestigial' lower sideband.

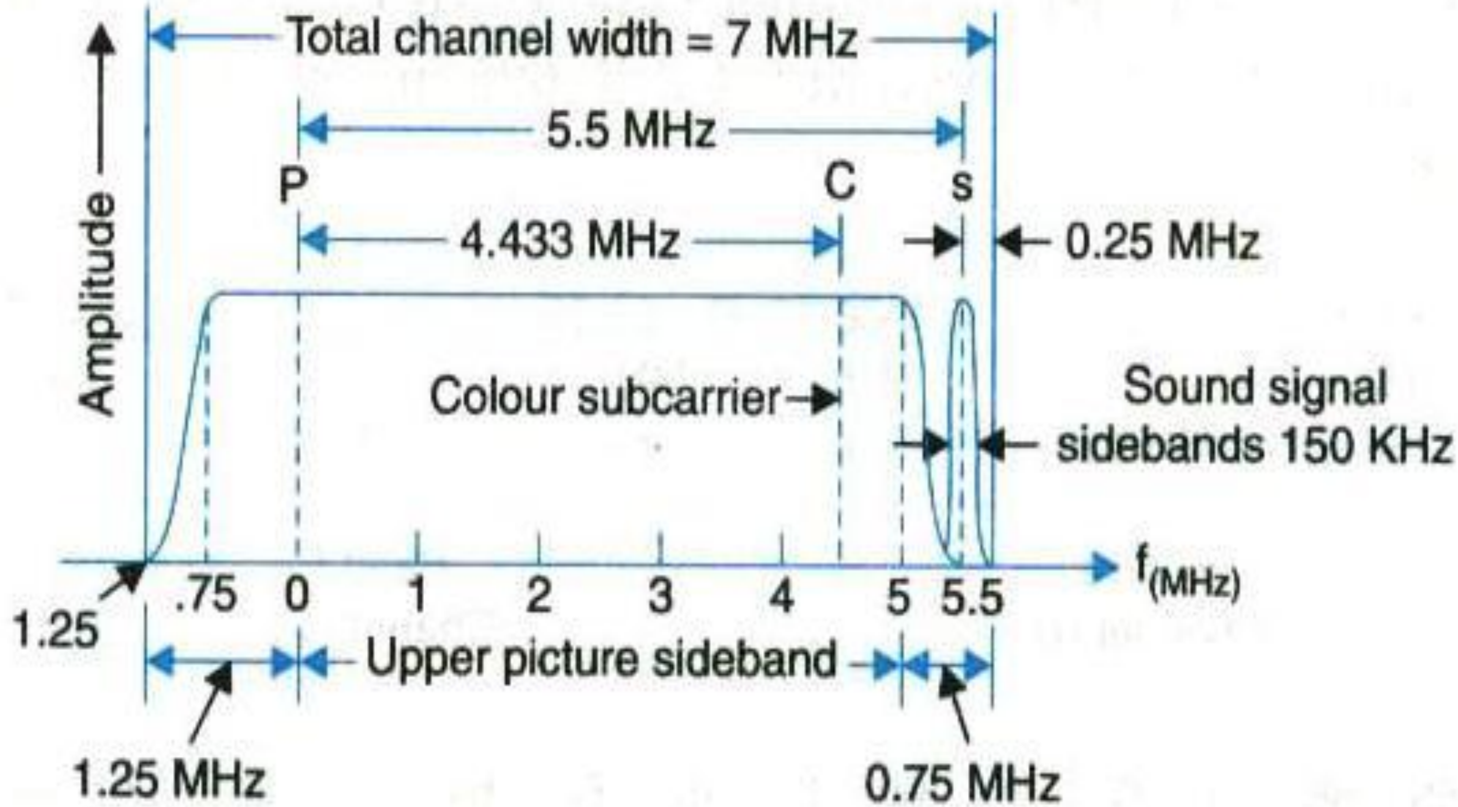


Fig. 4.4 C.C.I.R. (Indian and European) TV channel sideband spectrum. C is colour subcarrier frequency.

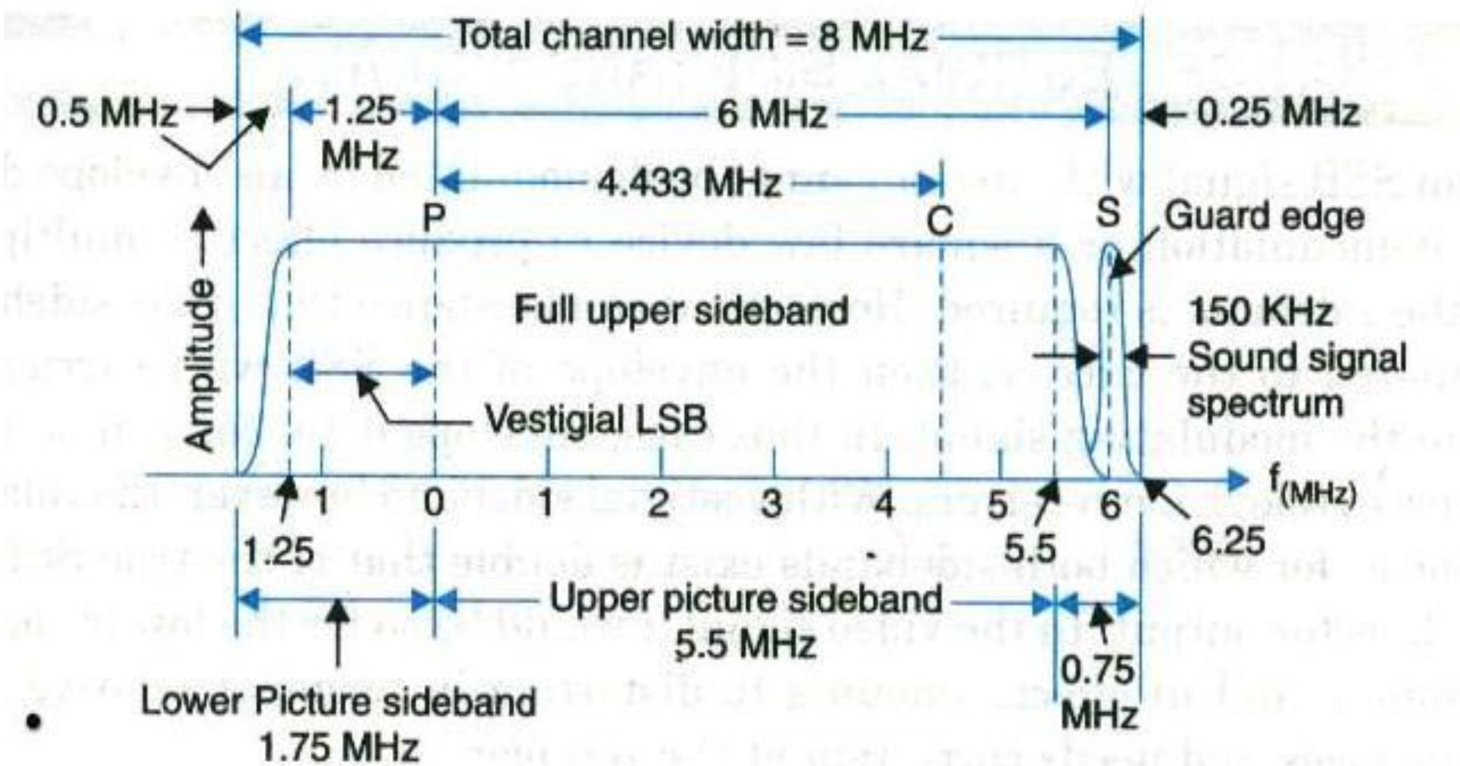


Fig. 4.5(a) U.K. TV channel standards.

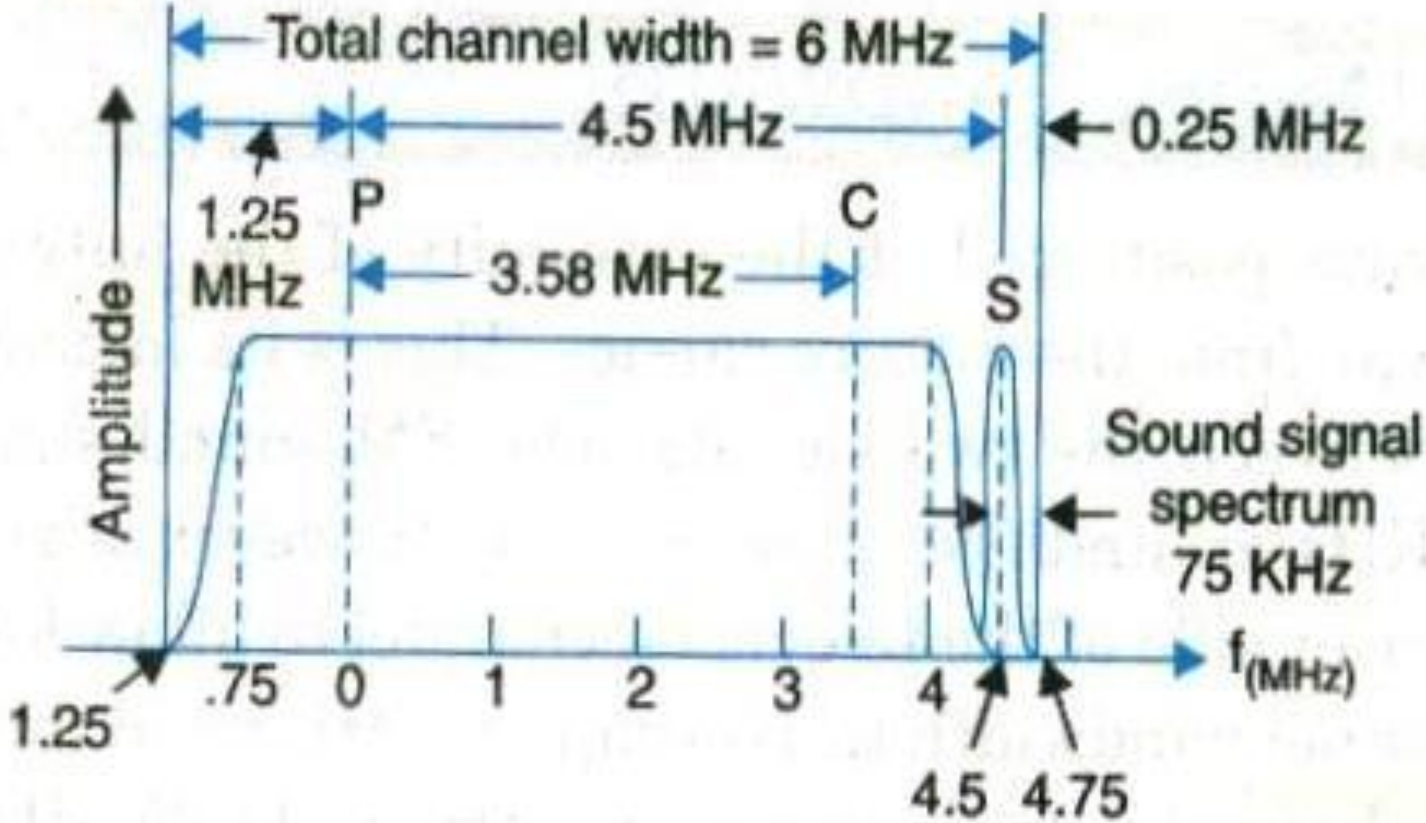


Fig. 4.5(b) American TV channel standards.

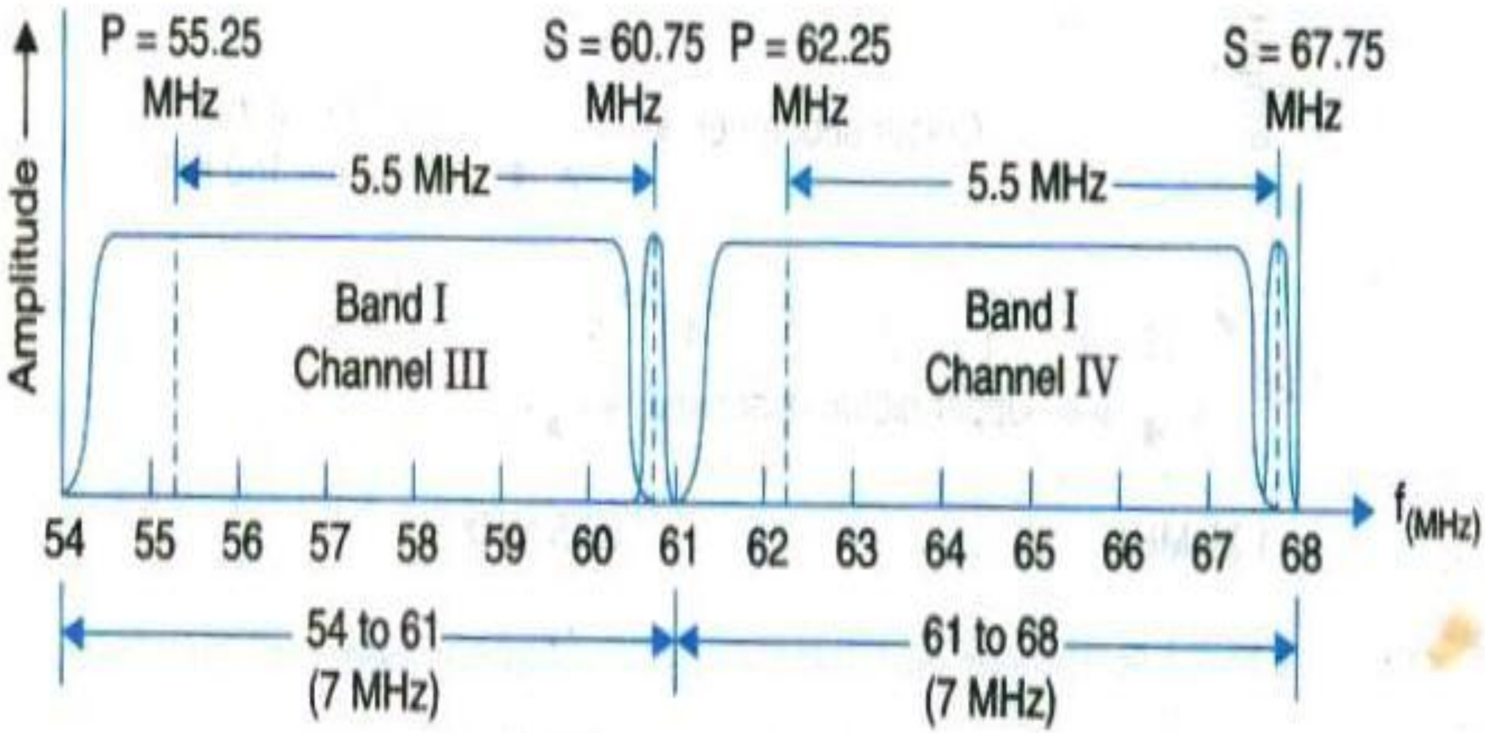


Fig. 4.6 Sideband spectrum of two adjacent channels of the lower VHF band of television station allocations.

Characteristics of the 625-B Monochrome TV System

No. of lines per picture (frame)	625
Field frequency (Fields/second)	50
Interlace ratio, *i.e.*, No. of fields/picture	2/1
Picture (frame) frequency, *i.e.*, Pictures/second	25
Line frequency and tolerance in lines/second, (when operated non-synchronously)	15625 ± 0.1%
Aspect Ratio (width/height)	4/3
Scanning sequence	(*i*) Line : Left to right (*ii*) Field : Top to bottom
System capable of operating independently of power supply frequency	YES
Approximate gamma of picture signal	0.5
Nominal video bandwidth, *i.e.*, highest video modulating frequency (MHz)	5
Nominal Radio frequency bandwidth, *i.e.*, channel bandwidth (MHz)	7
Sound carrier relative to vision carrier (MHz)	+ 5.5
Sound carrier relative to nearest edge of channel (MHz)	– 0.25
Nearest edge of channel relative to picture carrier (MHz)	– 1.25
Fully radiated sideband	Upper
Nominal width of main sideband (upper) (MHz)	5
Width of end-slope of full (Main) sideband (MHz)	0.5
Nominal width of vestigial sideband (MHz)	0.75
Vestigial (attenuated) sideband	Lower

TV

By KMN

ASPECT RATIO

- The frame adopted in all television systems is rectangular with width/height ratio, i.e., aspect ratio = 4/3.
- For human most of the motion occurs in the horizontal plane and so a larger width is desirable.
- The eyes can view with more ease and comfort when the width of a picture is more than its height.
- This enables direct television transmission of film programmes without wastage of any film area.
- This is achieved by setting the magnitudes of the current in the deflection coils to correct values, both at the TV camera and receiving picture tube.
- Synchronizing pulses are transmitted along with the picture information to achieve exact congruence between transmitter and receiver scanning systems

IMAGE CONTINUITY

- illusion of continuity and any motion in the scene appears on the picture tube screen as a smooth and continuous.
- the sensation produced when nerves of the eye's retina are stimulated by incident light does not cease immediately after the light is removed but persists for about 1/16th of a second.
- the scanning rate per second is made greater than sixteen, or the number of pictures shown per second is more than sixteen, the eye is able to integrate the changing levels of brightness in the scene.
- when the picture elements are scanned rapidly enough, they appear to the eye as a complete picture unit.
- In present day motion pictures twenty-four still pictures of the scene are taken per second and later projected on the screen at the same rate.
- Each picture or frame is projected individually as a still picture, but they are shown one after the other in rapid succession to produce the illusion of continuous motion of the scene

scanning

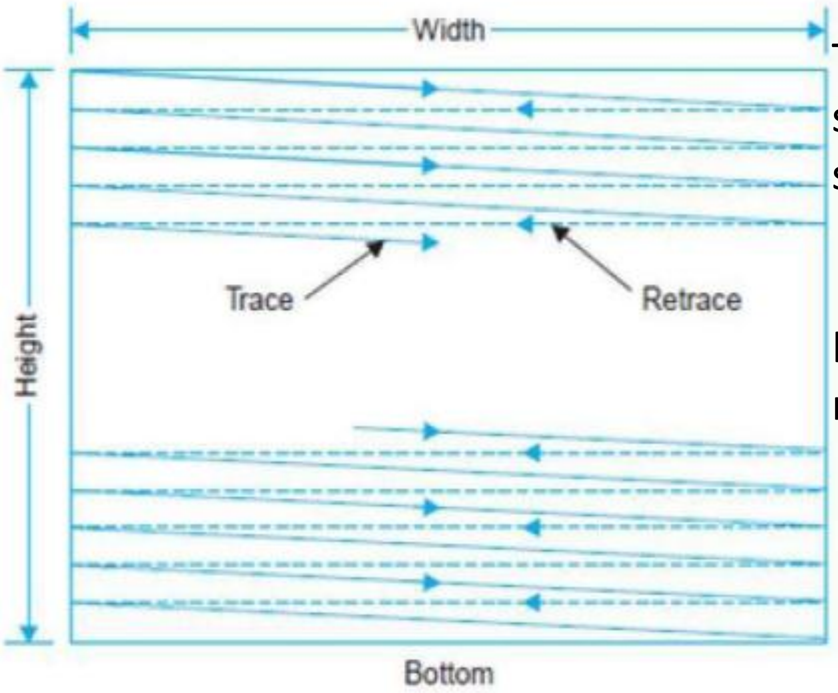
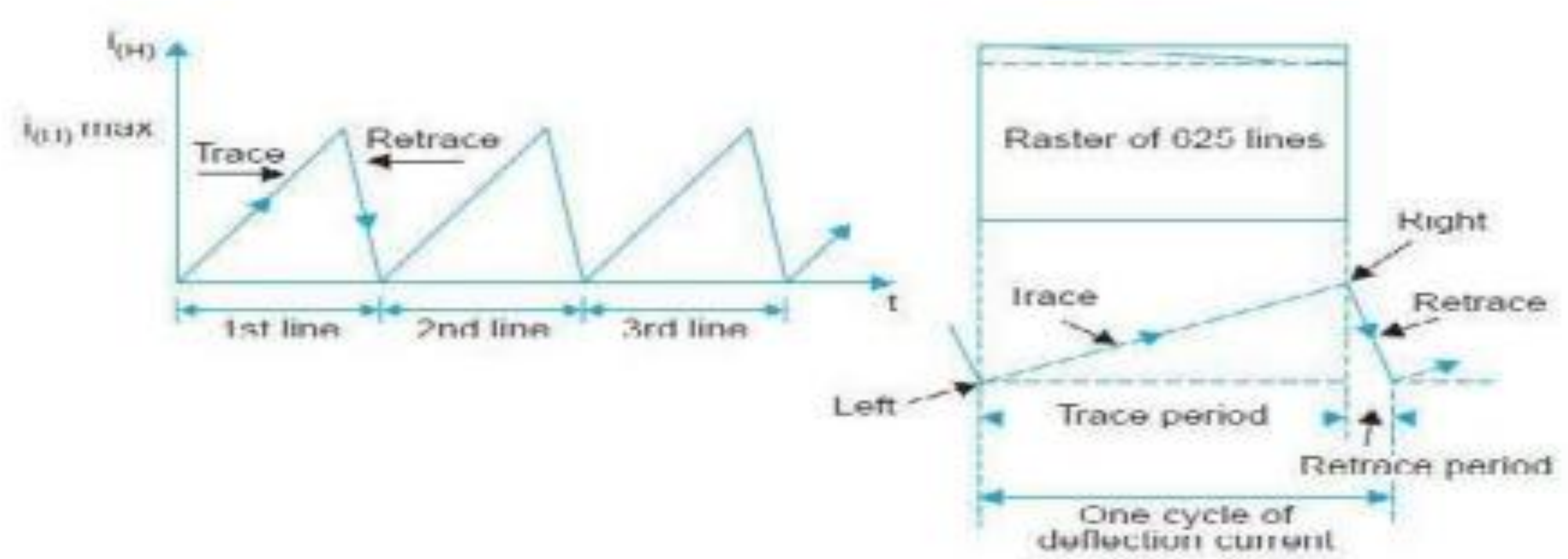


Figure. Path of scanning beam in covering picture area

The scene is scanned rapidly both in the horizontal and vertical directions simultaneously to provide sufficient number of complete pictures or frames per second to give the illusion of continuous motion.

Instead of the 24 as in commercial motion picture practice, the frame repetition rate is 25 per second in most television systems

Horizontal scanning

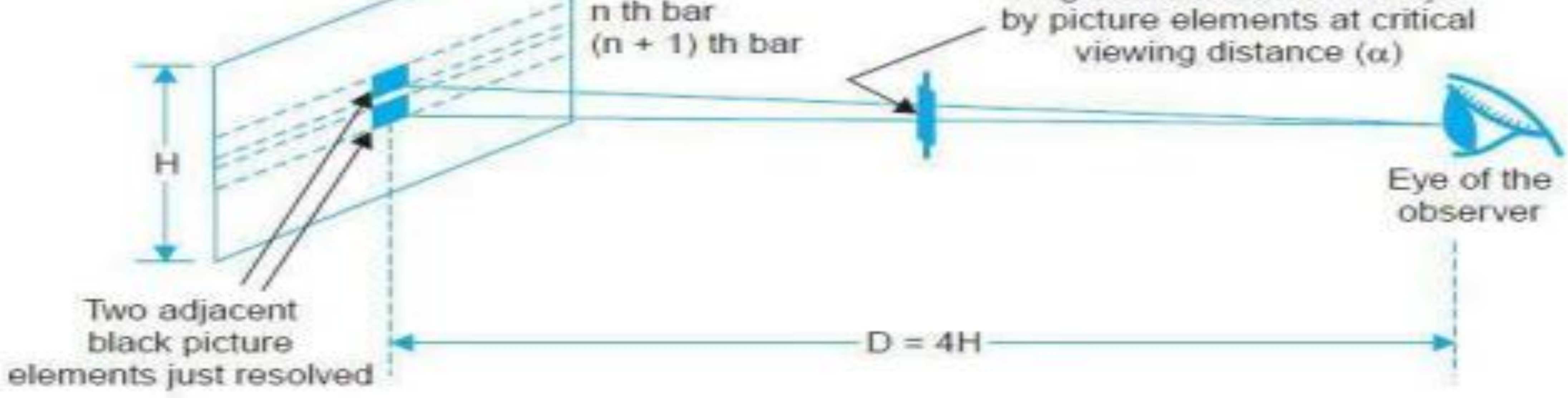


Waveform of current in the horizontal deflection coils producing linear (constant velocity) scanning in the horizontal direction.

- In Horizontal scanning. Fig. (a) shows the trace and retrace of several horizontal lines.
- The linear rise of current in the horizontal deflection coils Fig. (b) deflects the beam across the screen with a continuous, uniform motion for the trace from left to right.
- At the peak of the rise, the sawtooth wave reverses direction and decreases rapidly to its initial value.
- This fast reversal produces the retrace or flyback. The start of the horizontal trace is at the left edge of raster.
- In Vertical scanning The sawtooth current in the vertical deflection coils moves the electron beam from top to bottom of the raster at a uniform speed while the electron beam is being deflected horizontally.
- the rapid vertical retrace returns the beam to the top

continued

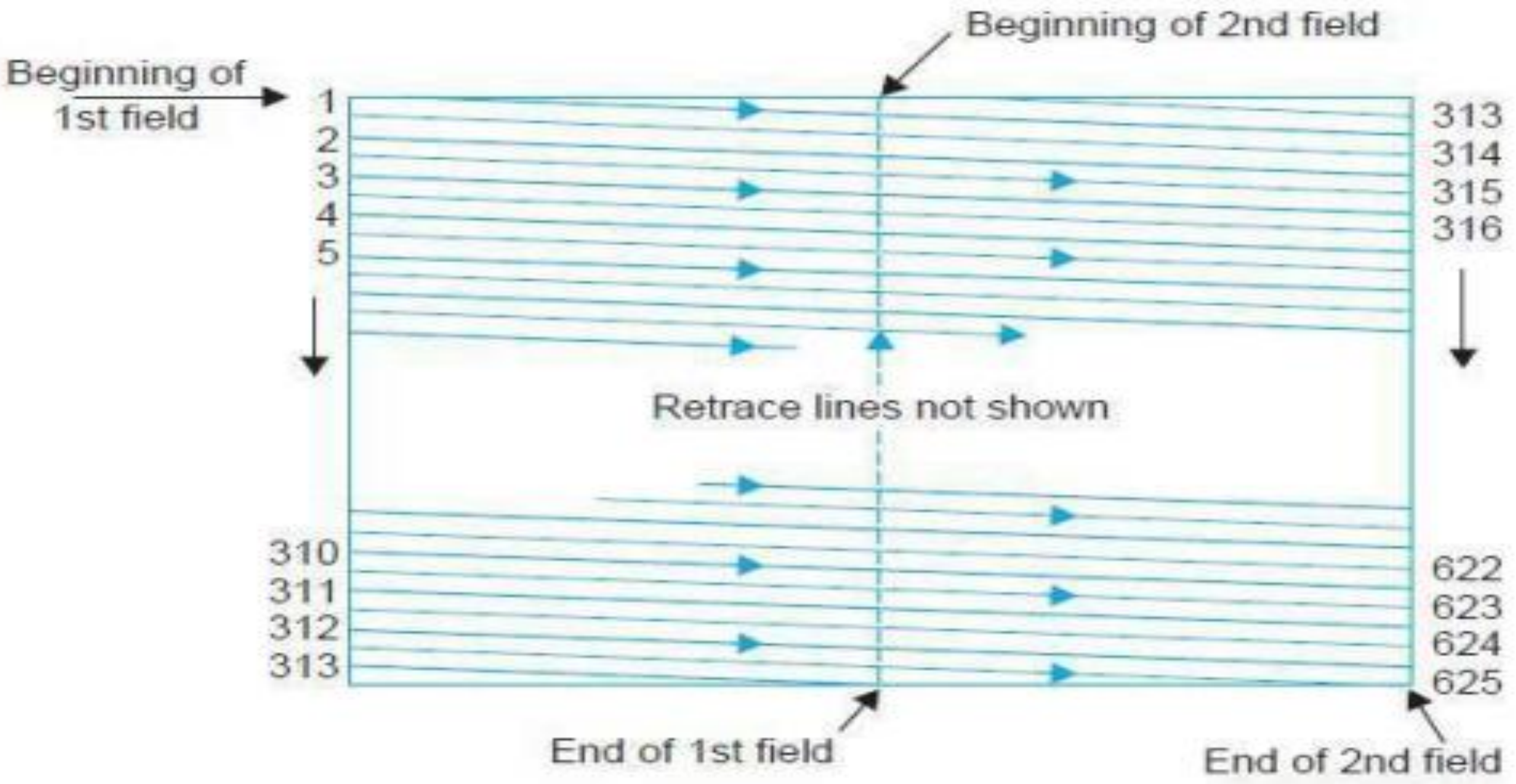
- The maximum number of alternate light and dark elements (lines) which can be resolved by the eye is given by
- $N_v = \alpha\rho$
- where N_v = total number of lines (elements) to be resolved in the vertical direction,
- α = minimum resolving angle of the eye expressed in radians,
- and $\rho = D/H$ = viewing-distance/picture height



Thus as a compromise between quality and cost, the total number of lines inclusive of those lost during vertical retrace has been chosen to be 625 in the 625-B monochrome TV system.

In the 525 line American system, the total number of lines has been fixed at 525 because of a somewhat higher scanning rate employed in this system.

Interlace scanning



Interlaced scanning.

- In television pictures an effective rate of 50 vertical scans per second is utilized to reduce flicker.
- This is accomplished by increasing the downward rate of travel of the scanning electron beam,
- so that every alternate line gets scanned instead of every successive line.
- when the beam reaches the bottom of the picture frame, it quickly returns to the top to scan those lines that were missed in the previous scanning.
- Thus the total number of lines are divided into two groups called ‘fields’. Each field is scanned alternately. This method of scanning is known as interlaced scanning.
- the 625 lines of each frame or picture are divided into sets of 312.5 lines and each set is scanned alternately to cover the entire picture area.

- To achieve this the horizontal sweep oscillator is made to work at a frequency of 15625 Hz (312.5 × 50 = 15625) to scan the same number of lines per frame (15625/25 = 625 lines.
- vertical sweep circuit is run at a frequency of 50 Hz.
- In the American TV system, a field frequency of 60 was adopted because the supply frequency is 60 Hz in USA.
- This brings the total number of lines scanned per second ((525/2) × 60 = 15750) lines to practically the same as in the 625 line system.

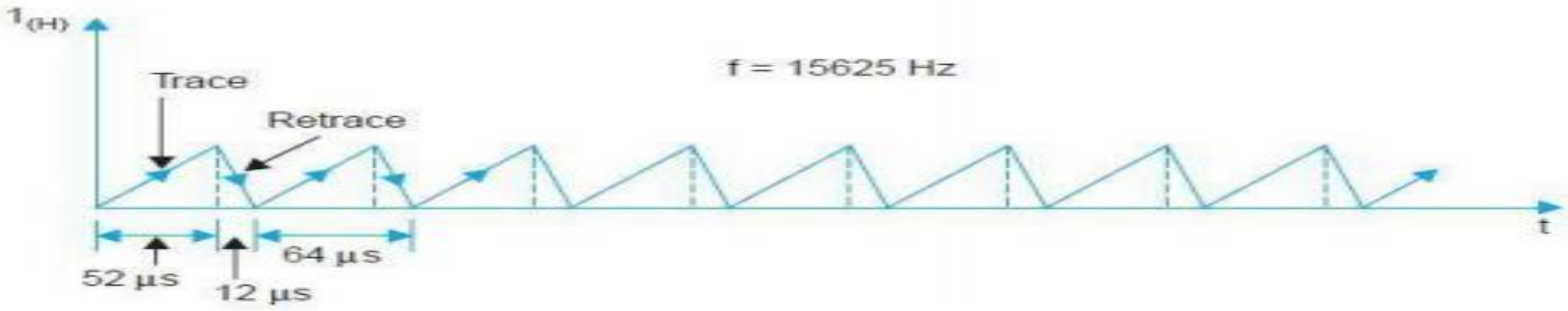


Figure. Horizontal deflection current

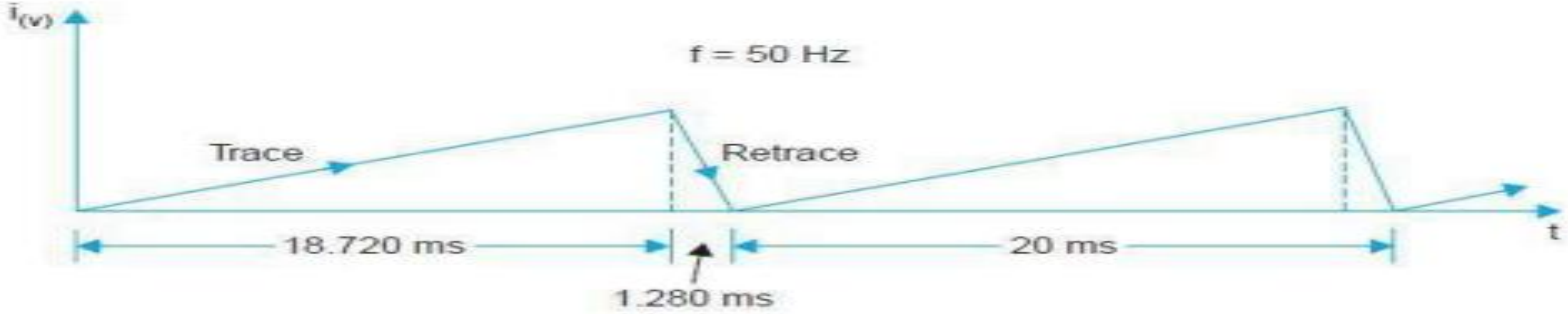


Figure. Vertical deflection current

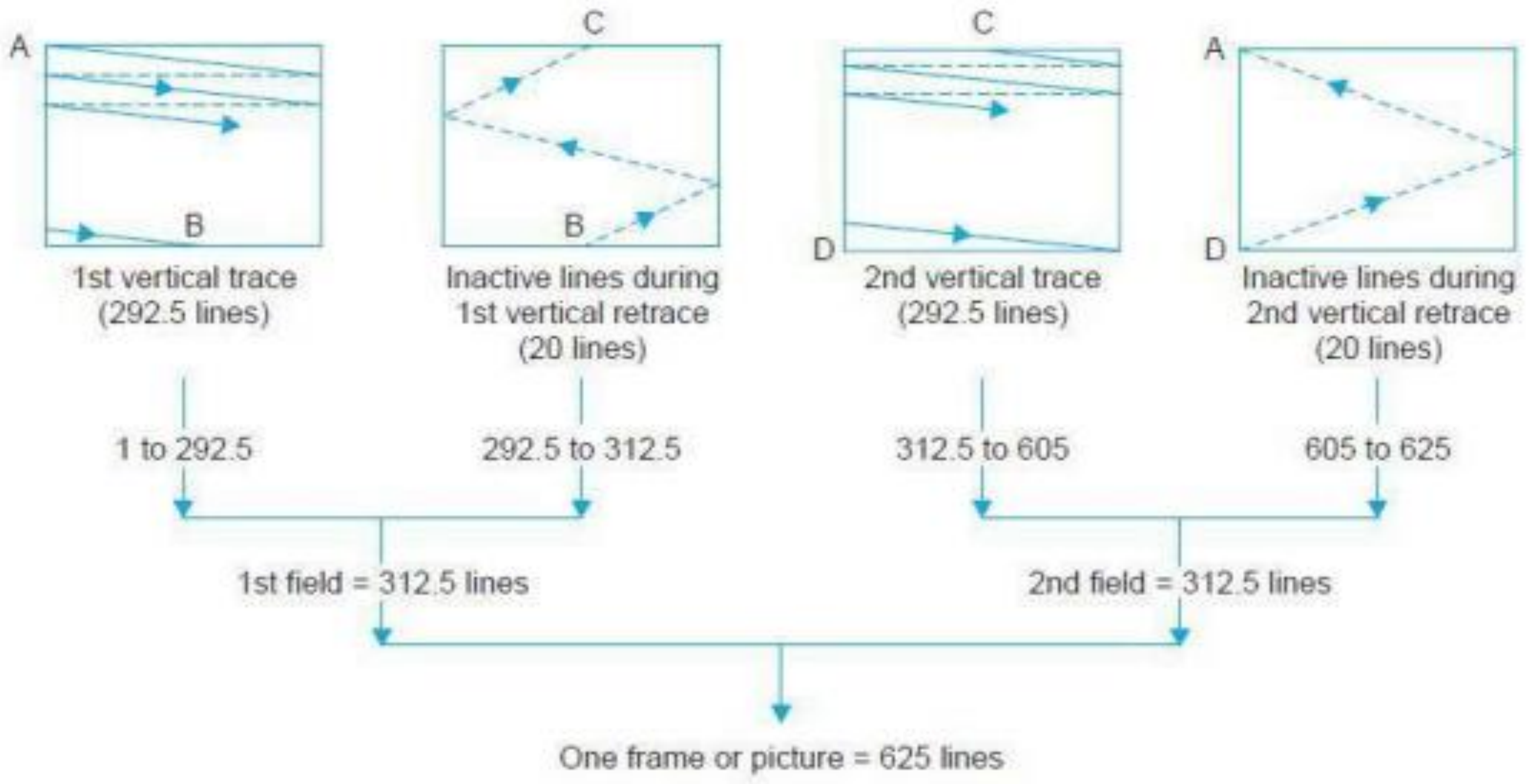


Figure. Odd line interlaced scanning procedure.

TELEVISION CAMERA TUBES

- Some of the more important functions,
- (i) sensitivity to visible light,
- (ii) wide dynamic range with respect to light intensity, and
- (iii) ability to resolve details while viewing a multi-element scene.

Challenges:

- (i) poor sensitivity, (ii) poor resolution, (iii) high noise level, (iv) undesirable spectral response, (v) instability, (vi) poor contrast range and (vii) difficulties of processing.

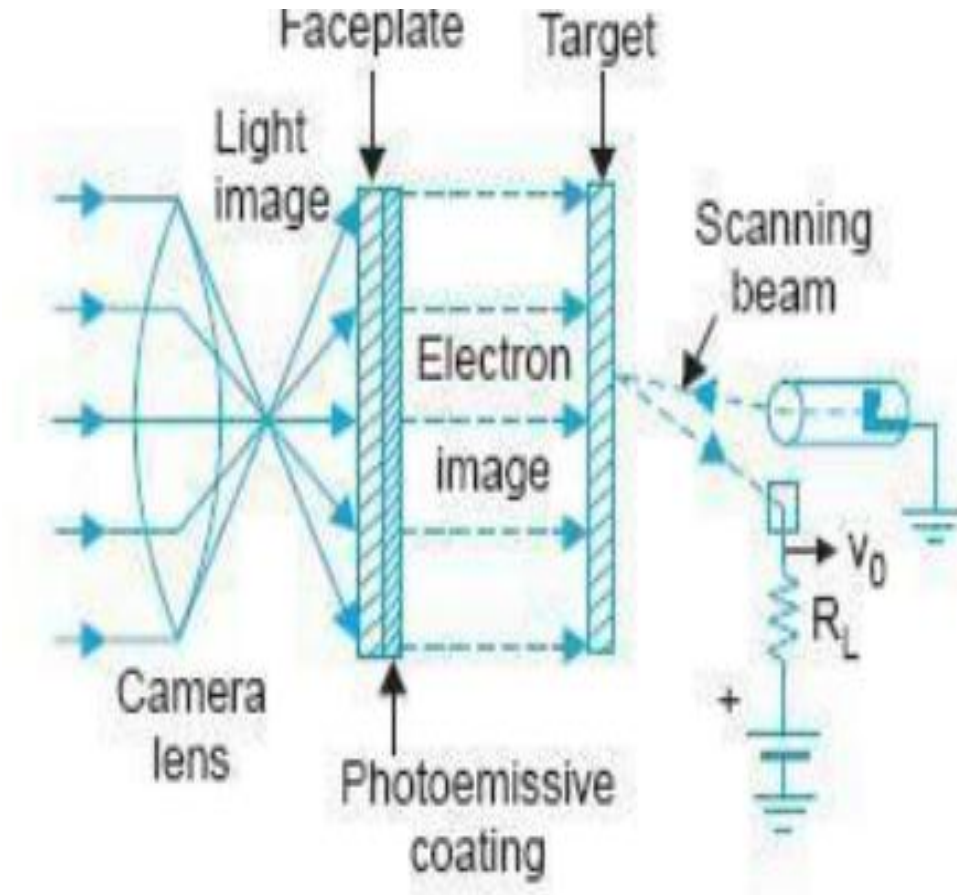


Figure. Production of video signal by photoemission

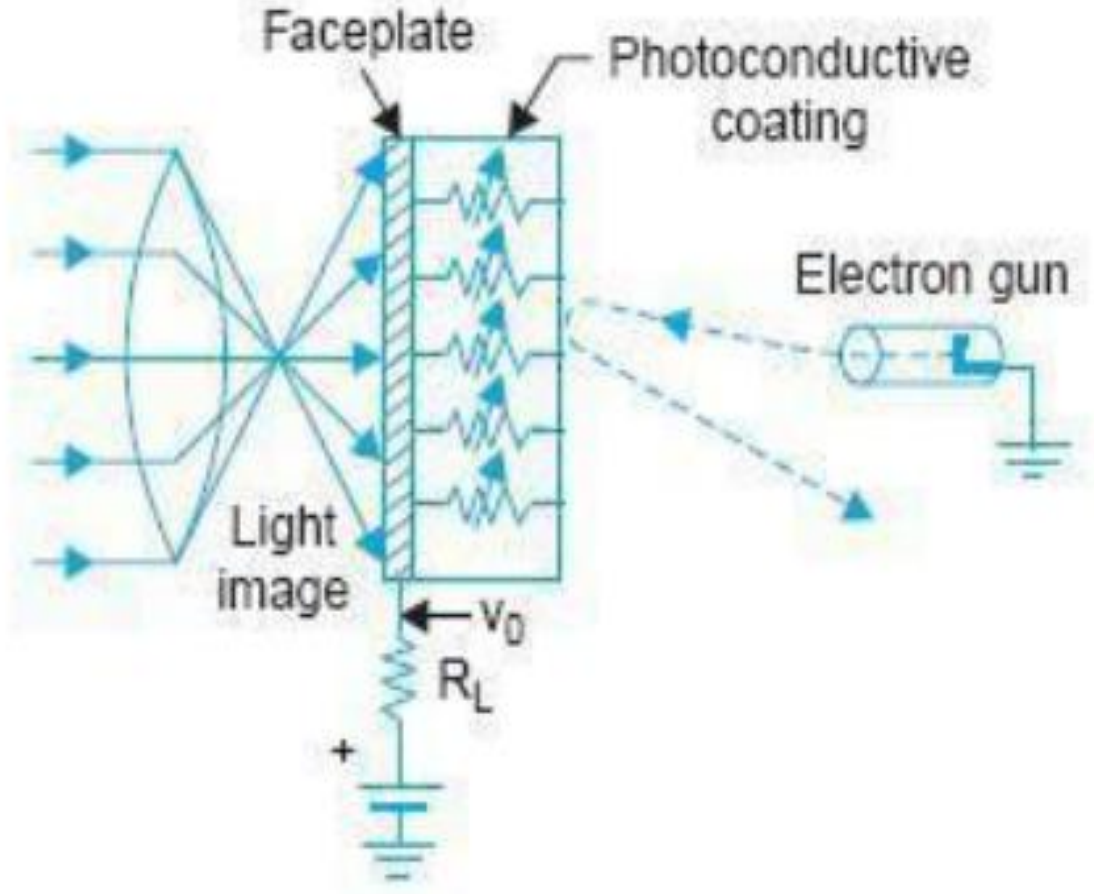


Figure. Production of video signal by photoconduction.

Electron multiplication

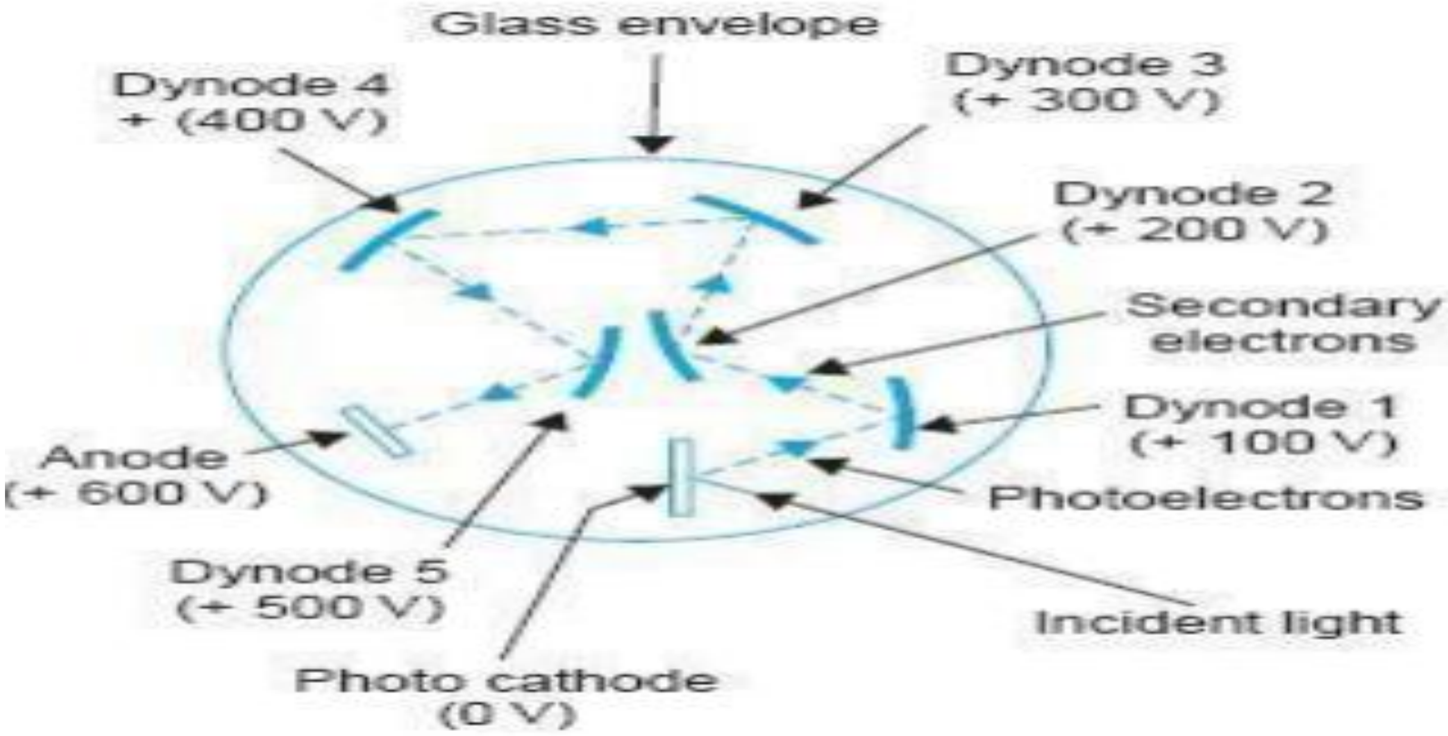


Figure. Illustration of an electron-multiplier structure.

Plumbicon camera tube

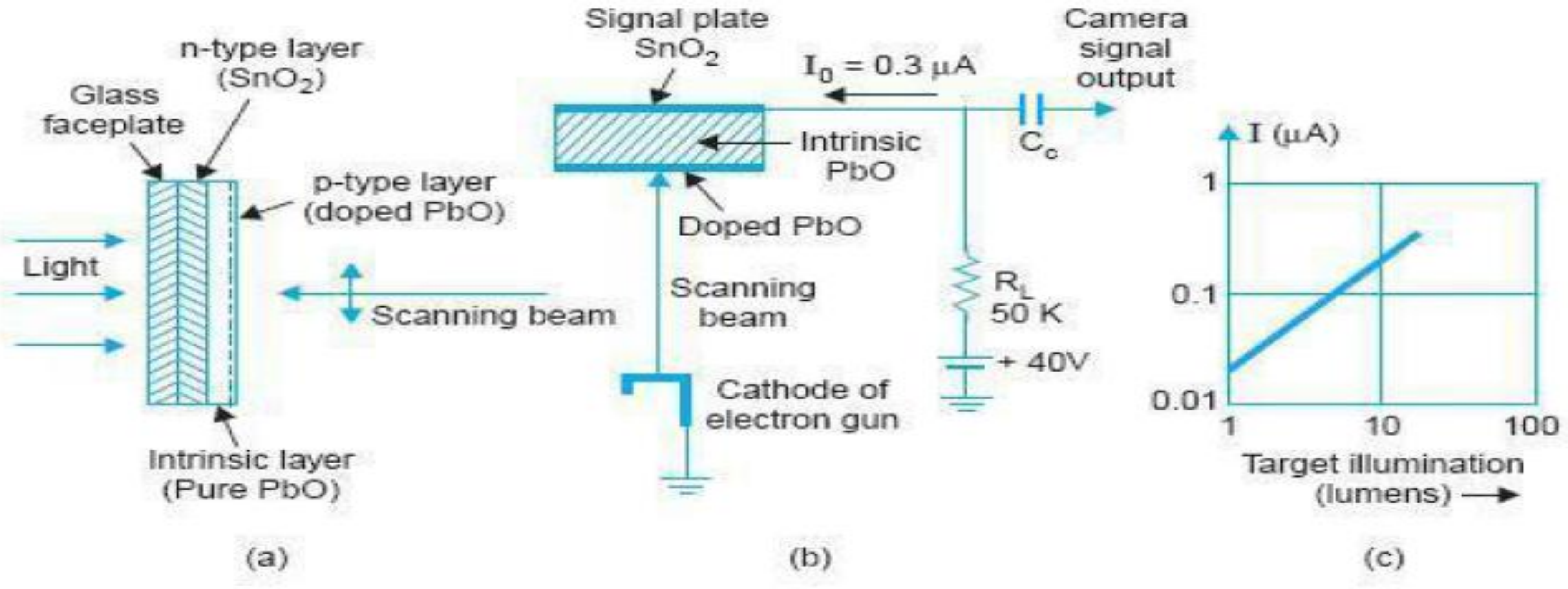
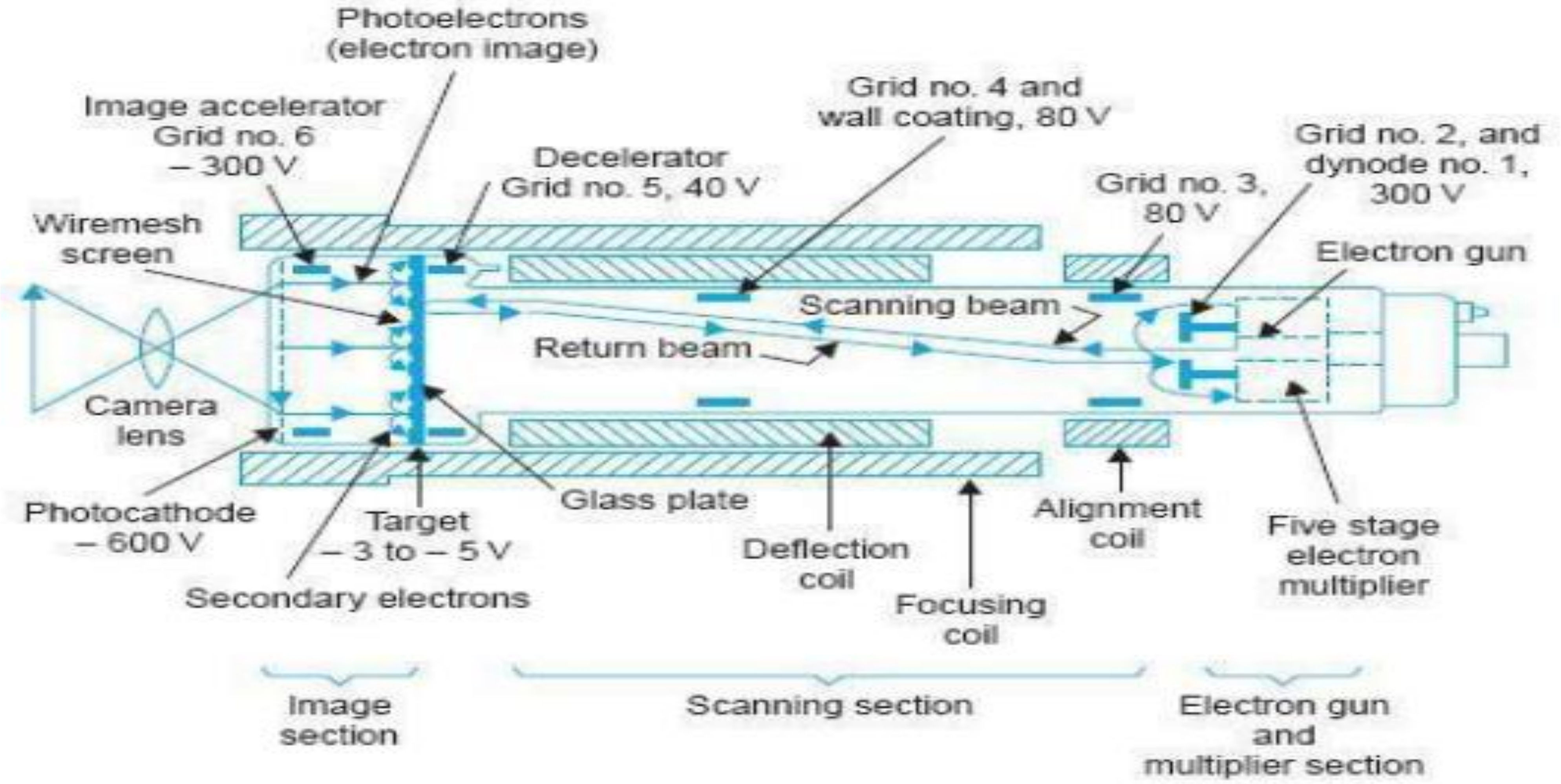


Figure. Plumbicon camera tube (a) target details (b) output signal current and (c) characteristics.

- plumbicon is very similar to the standard vidicon.
- the Focus and deflection are both obtained magnetically.
- it operates effectively as a P–I–N semi- conductor diode.
- The inner surface of the faceplate is coated with a thin transparent conductive layer of tinoxide (SnO_2).
- This forms a strong N layer and serves as the signal plate of the target.
- On the scanning side of this layer is deposited a photoconductive layer of pure lead monoxide (PbO) which is intrinsic or ‘I’ type.
- Finally the pure PbO is doped to form a P type semiconductor on which the scanning beam lands.

- The incidence of light on the target results in photo excitation of semiconductor junction between the pure PbO and doped layer.
- The resultant decrease in resistance causes signal current flow which is proportional to the incident light on each photo element.
- Theoverall thickness of the target is 10 to 20 µm.

IMAGE ORTHICON



Electron multiplication

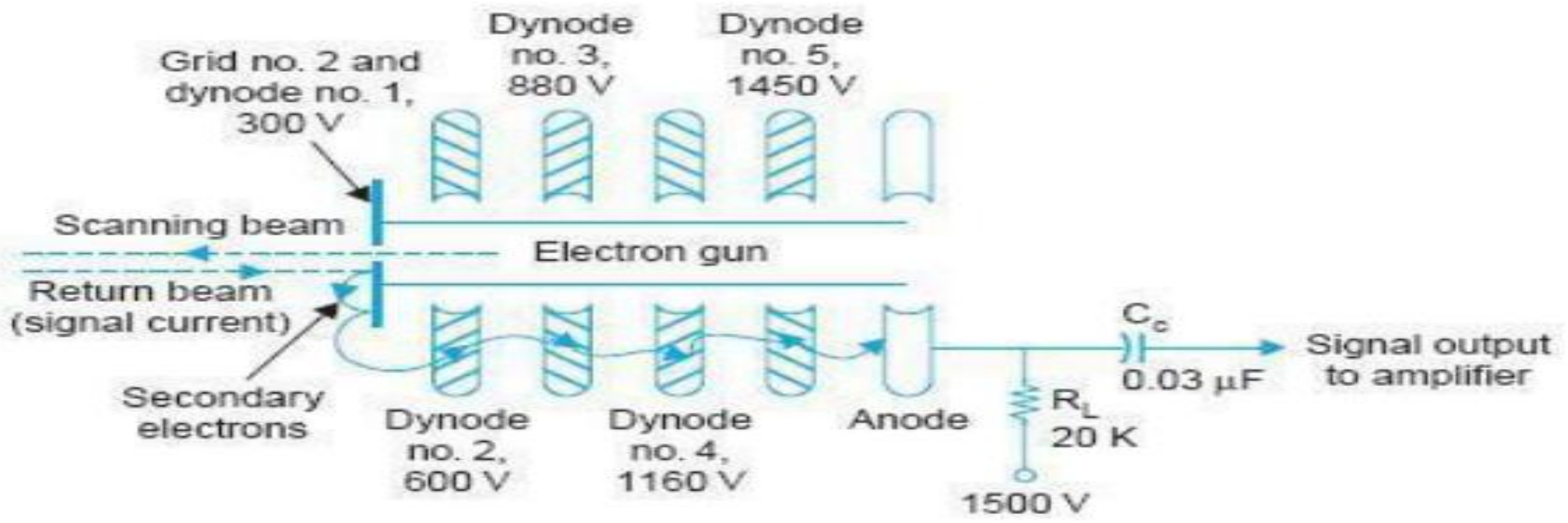


Figure. Electron-multiplier section of the Image Orthicon.

- This tube makes use of the high photo emissive sensitivity obtainable from photocathodes,
- image multiplication at the target caused by secondary emission and an electron multiplier
- It has three main sections: image section, scanning section and electron gun-cum-multiplier section.
- In Image Section The inside of the glass face plate at the front is coated with a silver, antimony coating sensitized with cesium, to serve as photocathode.

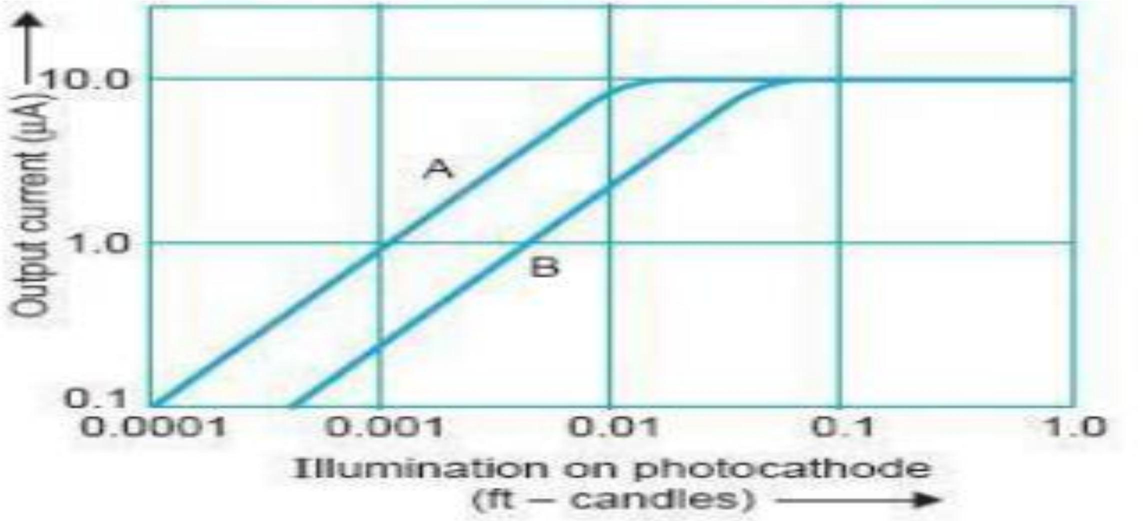
- the electron image produced at the photocathode is made to move towards the target plate located at a short distance from it. The target plate is made of a very thin sheet of glass and can store the charge received by it.
- Because of the high velocity attained by the electrons while in motion from photocathode to the target plate, secondary emission results, as the electrons bombard at the target surface.
- These secondary electrons are collected by a wire-mesh screen, which is located in front of the target on the image side and is maintained at a slightly higher potential with respect to the target

Scanning Section

- The electron gun structure produces a beam of electrons that is accelerated towards the target.
- Deflection of electron beams to scan the entire target plate is accomplished by magnetic fields of vertical and horizontal deflecting coils mounted on yoke external to the tube.
- These coils are fed from two oscillators, one working at 15625 Hz, for horizontal deflection, and the other operating at 50 Hz, for vertical deflection

Electron Multiplier

- When the returning electrons strike the disc which is at a positive potential of about 300 volts, with respect to the target, they produce secondary emission.
- The multiplication so obtained maintains a high signal to noise ratio.



igure. Light transfer characteristics of two different Image Orthicons.

Composite vedio signal

- A **composite video signal** is a single analog signal that combines **video (picture) information**, **synchronization pulses**, and sometimes **color information** into one waveform for transmission. Because all components Luminance (Y)and Chrominance (C) ie (Y + C + Sync) are **combined into one single signal** instead of being transmitted separately

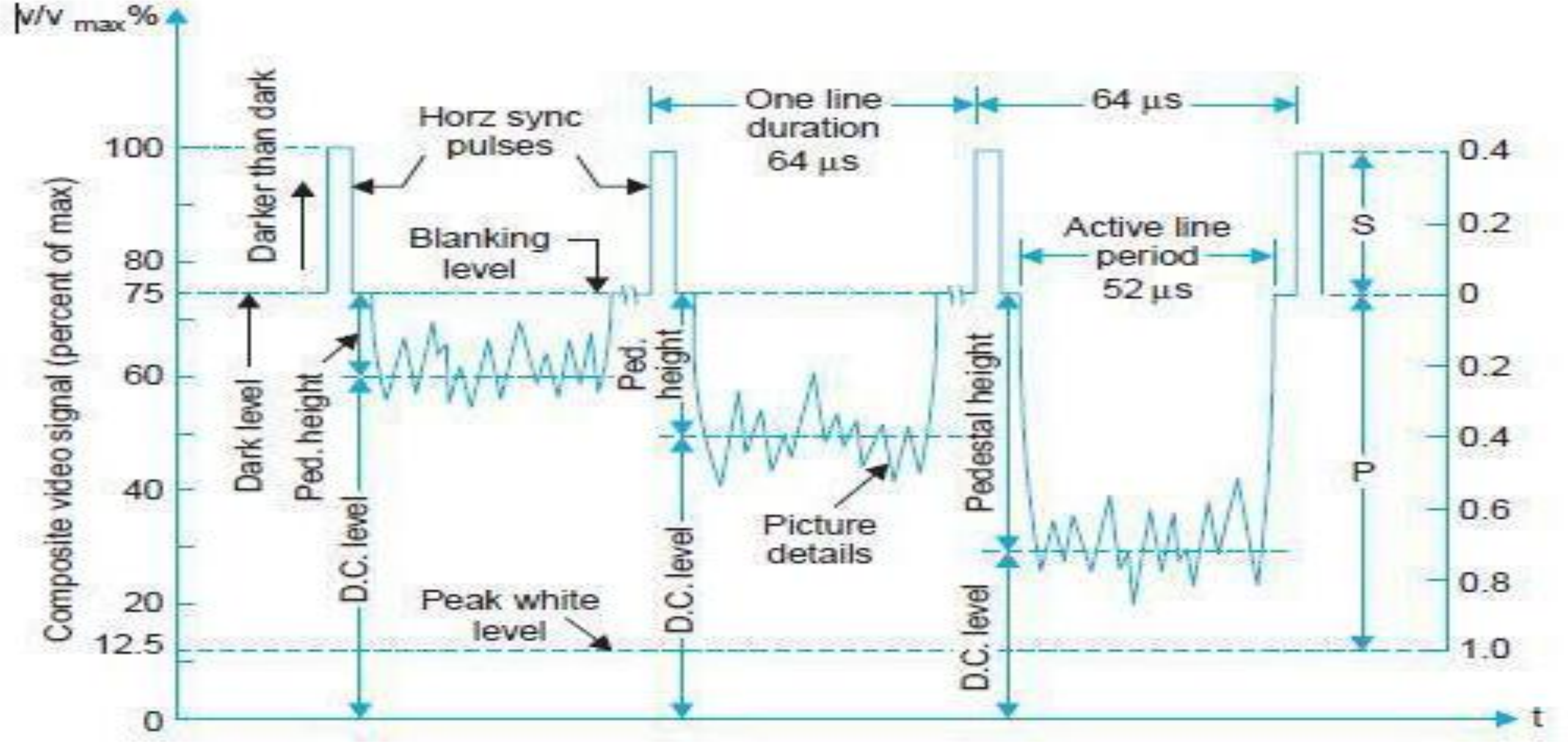
It was widely used in analog TV systems like:

NTSC

PAL

SECAM

Composite vedio signal



A composite video signal consists of three main parts:

Luminance (Y)

- Brightness information (black & white picture)
- Determines gray scale levels
- Contains picture details

Chrominance (C)

- Color information
- Superimposed on luminance using a color subcarrier
- Different frequency for NTSC and PAL systems

Synchronization Pulses

- Horizontal sync pulse → tells electron beam to move to next line
- Vertical sync pulse → tells beam to move to next frame
- Necessary for stable picture

Horizontal and Vertical Blanking pulses