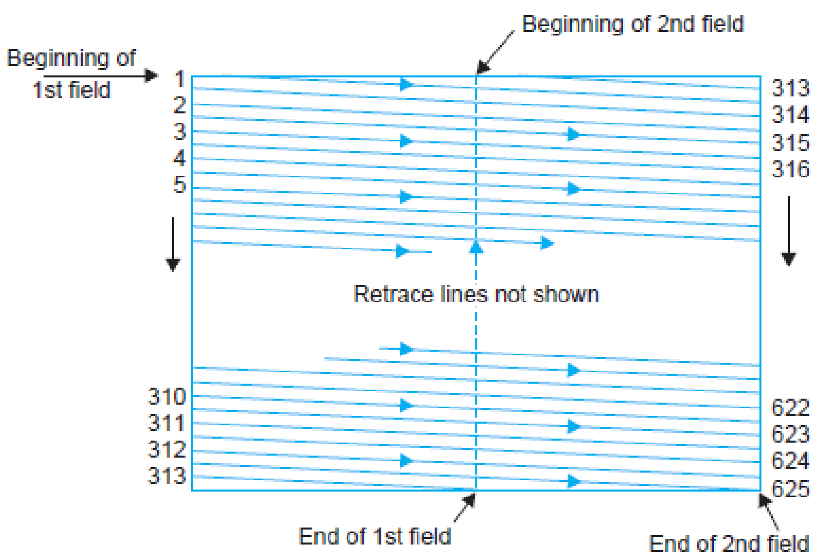
Q1.What do you understand by interlaced scanning? Show that it reduces flicker and conservebandwidth.

Ans

The rate of 24 pictures per second in motion pictures and that of scanning 25 framesper second in television pictures is enough to cause an illusion of continuity, they are not rapidenough to allow the brightness of one picture or frame to blend smoothly into the next throughthe time when the screen is blanked between successive frames. This results in a definiteflicker of light that is very annoying to the observer when the screen is made alternatelybright and dark.

This problem is solved in motion pictures by showing each picture twice, so that 48views of the scene are shown per second although there are still the same 24 picture framesper second. As a result of the increased blanking rate, flicker is eliminated.

Interlaced scanning.In television pictures an effective rate of 50 vertical scans per secondis utilized to reduce flicker. This is accomplished by increasing the downward rate of travel ofthe scanning electron beam, so that every alternate line gets scanned instead of every successiveline. Then, when the beam reaches the bottom of the picture frame, it quickly returns to thetop to scan those lines that were missed in the previous scanning. Thus the total numbers of lines are divided into two groups called 'fields'. Each field is scanned alternately. This methodof scanning is known as interlaced scanning and is illustrated in Fig. 2.4. It reduces flicker toan acceptable level since the area of the screen is covered at twice the rate. This is like readingalternate lines of a page from top to bottom once and then going back to read the remaininglines down to the bottom.



Principle of interlaced scanning.

In the 625 lime monochrome system, for successful 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), but the vertical sweep circuit is run at a frequency of 50 instead of 25 Hz. Note that since the beam is now deflected from top to bottom in half the time and the horizontal oscillator is still operating at 15625 Hz, only half the total lines, *i.e.*, 312.5 (625/2 =

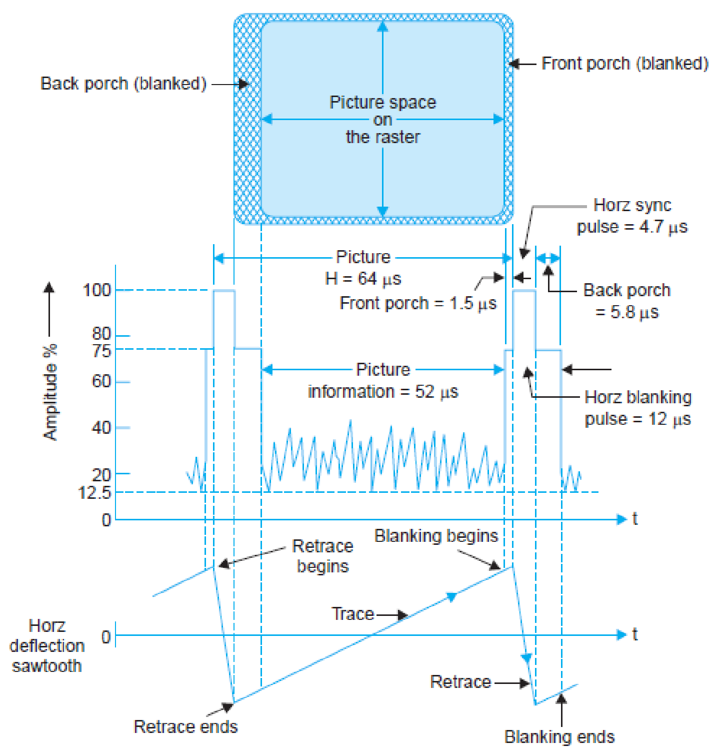
312.5) get scanned during each vertical sweep. Since the first field ends in a half line and the second field commences at middle of the line on the top of the target plate or screen (see Fig. 2.4), the beam is able to scan the remaining 312.5 alternate lines during its downward journey. In all then, the beam scans 625 lines (312.5 × 2 = 625) per frame at the same rate of 15625 lines (312.5 × 50 = 15625) per second. Therefore, with interlaced scanning the flicker effect is eliminated without increasing the speed of scanning, which in turn does not need any increase in the channel bandwidth. It may be noted that the frame repetition rate of 25 (rather than 24 as used in motion pictures) was chosen to make the field frequency equal to the power line frequency of 50 Hz. This helps in reducing the undesired effects of hum due to pickup from the mains, because then such effects in the picture stay still, instead of drifting up or down on the screen. 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.

Q2. Explain horizontal blanking period and sync pulse details

Ans.

The interval between horizontal scanning lines is indicated by *H*. Out of a total line period of 64 µs, the line blanking period is 12 µs. During this interval a line synchronizingpulse is inserted. The pulses corresponding to the differentiated leading edges of the syncpulses are actually used to synchronize the horizontal scanning oscillator. The line blanking period is divided into three sections. These are the 'front porch', the 'line sync' pulse and the 'back porch'. The time intervals allowed to each part are summarizedbelow and their location and effect on the raster is illustrated



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

*Front porch.*This is a brief cushioning period of 1.5 µs inserted between the end of the picture detail for that line and the leading edge of the line sync pulse. This interval allows the receiver video circuit to settle down from whatever picture voltage level exists at the end of the picture line to the blanking level before the sync pulse occurs. Thus sync circuits at the receiver are isolated from the influence of end of the line picture details. The most stringent demand is made on the video circuits when peak white detail occurs at the end of a line. Despite the existence of the front porch when the line ends in an extreme white detail, and the signal amplitude touches almost zero level, the video voltage level fails to decay to the blanking level before the leading-edge of the line sync pulse occurs. This results in late triggering of the time base circuit thus upsetting the 'horz' line sync circuit. As a result the spot (beam) is late in arriving at the left of the screen and picture information on the next line is displaced to the left. This effect is known as 'pulling-on-whites'.

*Line sync pulse.*After the front porch of blanking, horizontal retrace is produced when the sync pulse starts. The flyback is definitely blanked out because the sync level is blacker than black. Line sync pulses are separated at the receiver and utilized to keep the receiver line time base in precise synchronism with the distant transmitter. The nominal time duration for the line sync pulses is 4.7 µs. During this period the beam on the raster almost completes its back stroke (retrace) and arrives at the extreme left end of the raster.

*Back porch.*This period of 5.8 µs at the blanking level allows plenty of time for line flyback to be completed. It also permits time for the horizontal time-base circuit to reverse direction of current for the initiation of the scanning of next line. In fact, the relative timings are so set that small black bars are formed at both the ends of the raster in the horizontal plane. These blanked bars at the sides have no effect on the picture details reproduced during the active line period. The back porch* also provides the necessary amplitude equal to the blanking level (reference level) and enables to preserve the dc content of the picture information at the transmitter. At the receiver this level which is independent of the picture details is utilized in the AGC (automatic gain control) circuits to develop true AGC voltage proportional to the signal strength picked up at the antenna.

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

Q3. Explain Sync Detailsof the 525 Line System

Ans.

A complete chart giving line numbers and pulse designations for both the fields is given below:

First Field (odd field)

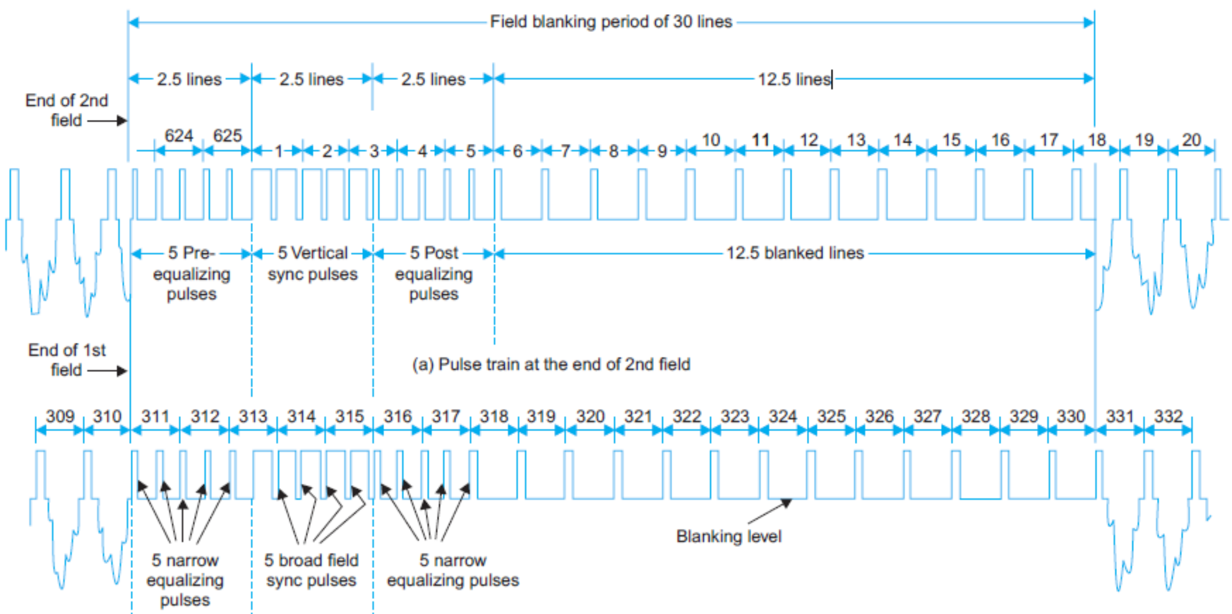
Line numbers: one to 1st-half of 313th line (312.5 lines)

1, 2 and 3rd 1st-half, lines 2.5 lines—Vertical sync pulses

3rd 2nd-half, 4, and 5 2.5 lines—Post-vertical sync equalizing pulses.
6 to 17, and 18th 1st-half 12.5 lines—blanking retrace pulses
18th 2nd-half to 310 292.5 lines—Picture details
311, 312, and 313th 1st-half 2.5 lines—Pre-vertical sync equalizing pulses for the 2nd field.
Total number of lines = 312.5

Second field (even field)

Line numbers: 313th 2nd-half to 625 (312.5 lines)
313th 2nd-half, 314, 315 2.5 lines—Vertical sync pulses
316, 317, 318th 1st-half 2.5 lines—Post-vertical sync equalizing pulses
318th 2nd-half-to 330 12.5 lines—Blanking retrace pulses
331 to 1st-half of 623rd 292.5 line—Picture details
623 2nd-half, 624 and 625 2.5 lines—Pre-vertical sync equalizing pulses For the 1st field
Total number of lines = 312.5
Total Number of Lines per Frame = 625



(b) Pulse train at the end of 1st field

*Approximate location of line numbers.*The serrated vertical sync pulse forces the vertical deflectioncircuitry to start the flyback. However, the flyback generally does not begin with the start of vertical sync because the sync pulse must build up a minimum voltage across the capacitor to trigger the scanning oscillator. If it is assumed that vertical flyback starts with the leading edge of the fourth serration, a time of 1.5 lines passes during vertical sync before verticalflyback starts. Also five equalizing pulses occur before vertical sync pulse train starts.Then four lines (2.5 + 1.5 = 4) are blanked at the bottom of the picture before vertical retrace begins. A typical vertical retrace time is five lines. Thus the remaining eleven (20 – (4 + 5) = 11) lines are blanked at the top of the raster. These lines provide the sweep oscillator enough time to adjust to a linear rise for uniform pick-up and reproduction of the picture.