



Monochrome and Colour Picture Tubes

A.KARTHIKEYAN, AP/ECE

Monochrome :

Construction:

- ▶ The electron gun unit has a cathode, control grid and accelerating anode. The cathode (K) is a small metallic oxide disk placed at the end of a narrow tube that covers the heater. It is heated to produce thermionic emission and thus serves as source of electrons for the beam current.
- ▶ The control grid (G1) is used to control the flow of electrons from the cathode (K). The control grid (G1) is maintained at negative potential with respect to cathode (K).
- ▶ The grids that follow the control grid are the accelerating grid (or) screen (G2) and focussing grid (G3).these are maintained at different positive potentials with respect to cathode (K).
- ▶ All the grids, cathode, heater elements of the electron gun are connected to the base pins. Through this base pins only necessary voltages are applied.

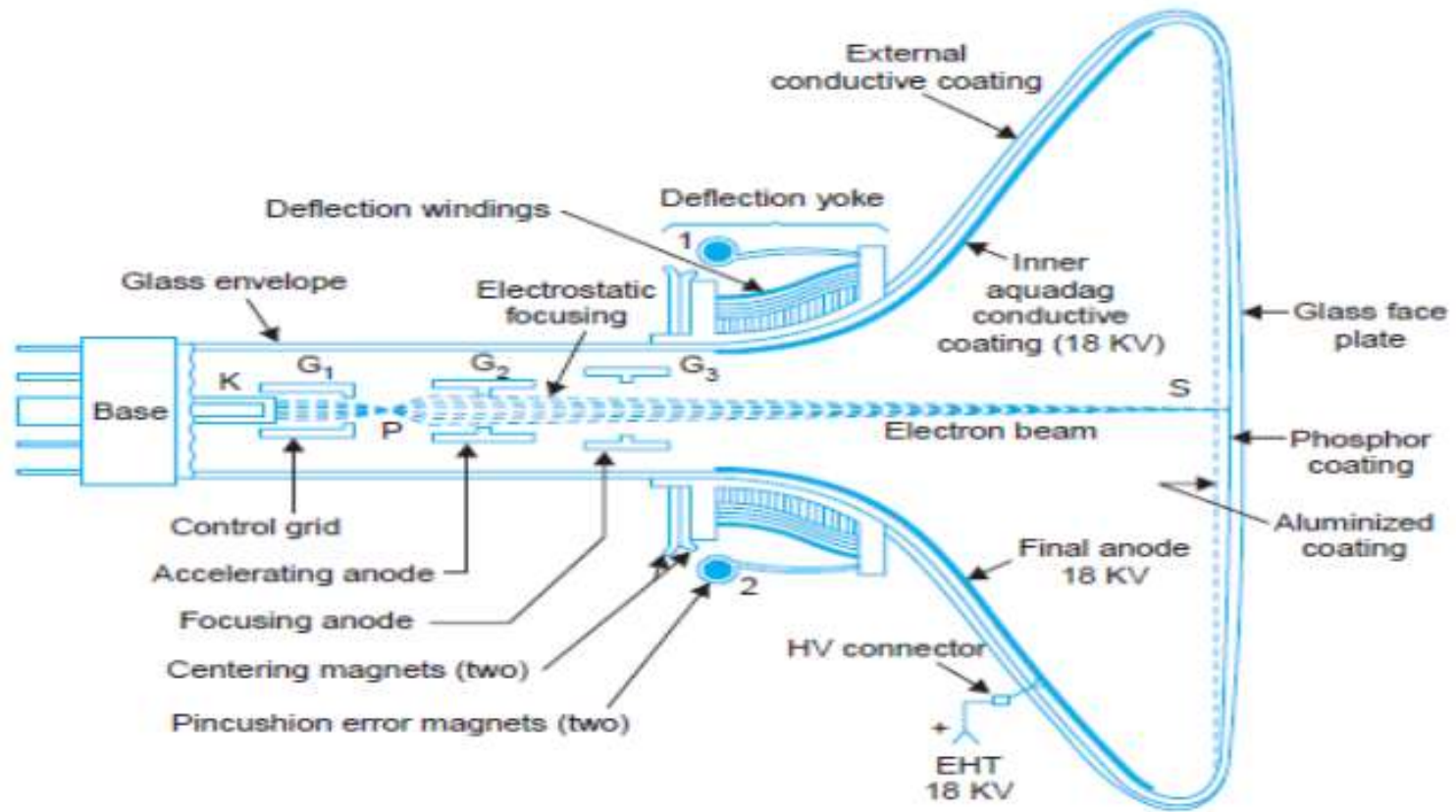


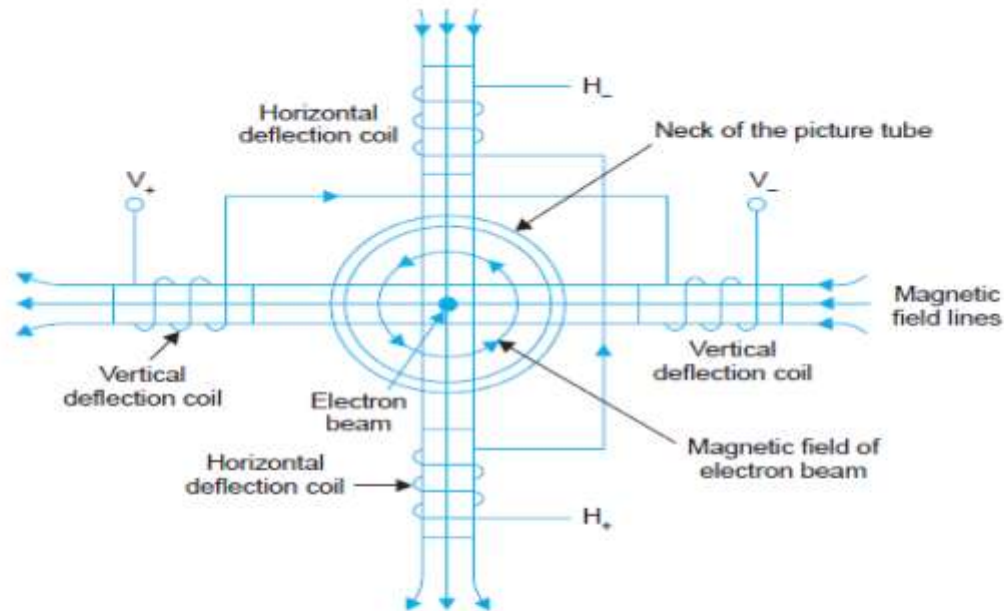
Fig 2.7 Monochrome picture tube

Focussing anode section:

- ▶ Electrostatic focussing method is used here, to focus the electron beam. This section also brings all the electrons in the stream into small spot. It is considered as first electrostatic lens action.
- ▶ The second lens system consists of screen grid are so selected that the second convergence point is on the screen of the picture tube.

Deflection coil section:

- ▶ Here we are using electromagnetic system to deflect the electron beam in horizontal and vertical direction. one pair of deflection coils is placed left and right side neck of the picture tube to produce vertical deflection and one pair is placed top and bottom side of the neck to produce horizontal deflection.
- ▶ The two pairs of coils are collectively called deflection yoke. The magnetic field in the coil reacts with the electron beam to make the deflection.
- ▶ In the deflection yoke centering magnet and pin cushion magnet are also provided for centering the electron beam and adjusting the movement of the electron beam at the corners.



Horizontal and Vertical deflecting coils (pairs) around the neck of the picture tube. Note that the location of the beam on the picture tube screen will depend on the strength and direction of currents in the two pairs of coils. For the directions of current shown the beam will be deflected upwards and to the left.

Fig 2.8 Deflection angle

Final anode section:

- ▶ A final anode is included in the tube, to provide sufficient velocity and energy for the electron beam.
- ▶ A black graphite material coating called aquadag, it is used as final anode. It is connected through a specially provided pin at the top or side of the glass bell to a very high potential of over 15kv.
- ▶ The secondary electrons emitted from the screen are attracted by these aquadag coating.

Phosphor screen:

- ▶ The phosphor chemicals are generally light materials such as zinc and cadmium in the form of sulphate and phosphate compounds.
- ▶ This material is proceeded to produce very fine particles which are then applied on the inside of the glass plate.
- ▶ The high velocity electrons of the beam on hitting the phosphor excite its atoms with the result that corresponding spot fluoresces and emit light.

External conductive coating:

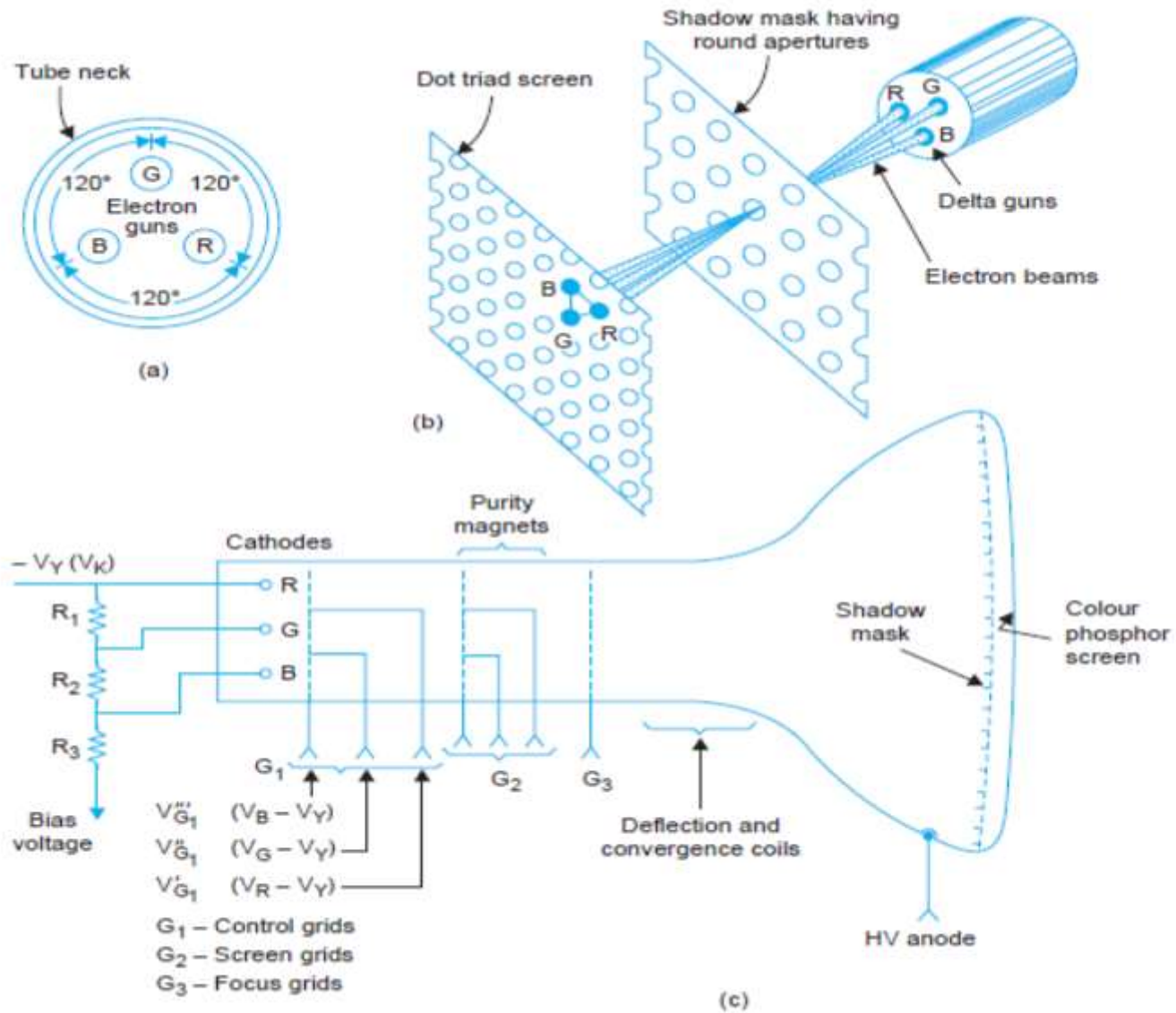
- ▶ Aquadag is also coated on the outer surface of the glass bell. A spring clip is used to connect this coating with the chassis ground.
- ▶ This coating is used to filter the AC ripples in high voltage and to provide a perfect higher voltage.

Color picture tube – Delta gun picture tube:

- ▶ In this color picture tube the three guns are arranged in a rectangular form and hence the name delta gun tube. It was developed by Radio Corporation of America. Main sections:
 1. Electron gun section
 2. Screen and shadow mask section

Electron gun section:

- ▶ The three guns are spaced equally at 120 degree with one another. They are tilted inward with respect to axis of the tube. The three guns are in the three corners and form delta shape.
- ▶ The three independent electron beams for each primary color come out of the three guns. • Each gun has a heater filament, cathode, control grid and accelerating anode. The accelerating anodes are supplied EHT of about 25 kV.
- ▶ While the focussing grids are provided an adjustable potential of about 5 to 75 kV for optimum focus.
- ▶ The deflection yoke design is more complex, since, we have to deflect three electron beams at a time.
- ▶ The purity magnets are used to adjust the axis of electron beams so that they can strike the correct phosphor dot at the screen.



- ▶ Each dot represents one primary colour. Depending on the screen size nearly 3 lacs to 4 lacs triads are formed over the screen.
- ▶ The diameter of the each dot is about 0.42 mm and each spaced some 0.72 mm apart triangularly.
- ▶ Shadow mask is a thin perforated metal sheet. It is placed behind the screen. Shadow mask has one hole for each triad on the screen.
- ▶ This arrangement moves the electron beam passing through a hole and hit only one triad on the screen.

Advantages:

- ▶ Better focussing, if best possible ratio of gun-to-neck diameter is achieved.

Disadvantages:

- ▶ Shadow mask absorbs 80% of beam current.
- ▶ Beam convergence is a complex process.