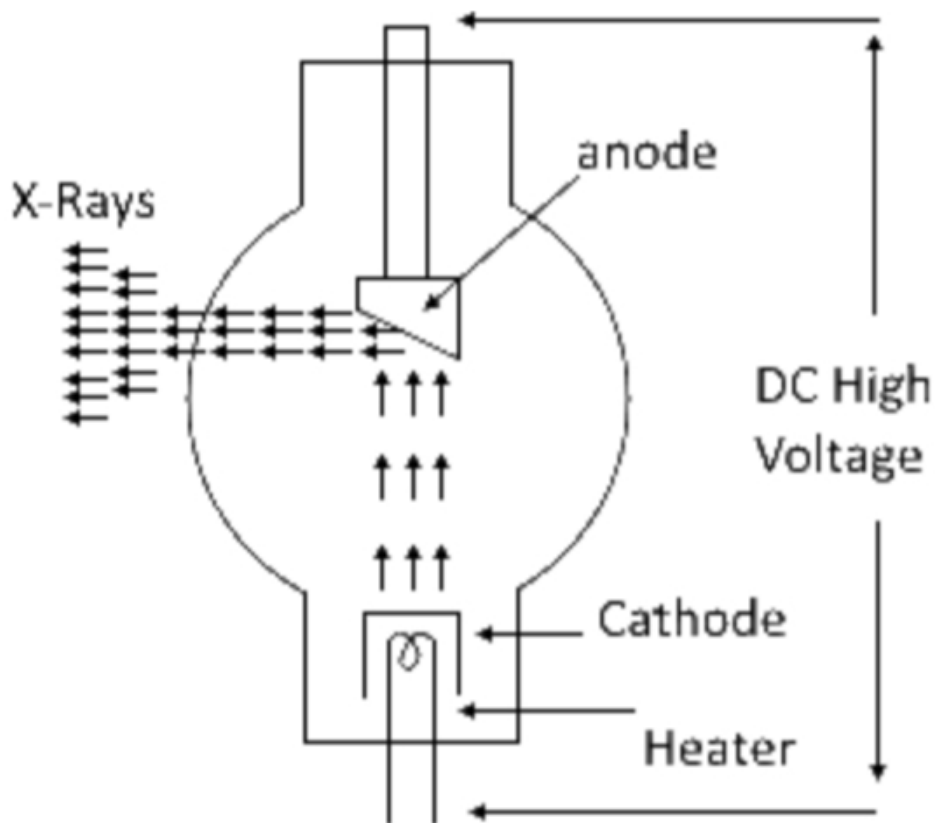


# X-Rays

Three types of rays emit continuously from a radium material. These rays are known as alpha rays ( $\alpha$  rays), Beta rays ( $\beta$  rays) and gamma rays ( $\gamma$  rays). Gamma rays also known as x-rays. The frequency of x-rays is approximately  $10^{16}$  Hz and its wavelength is approximately  $10^{-10}$  meter. X-rays are electromagnetic waves which are widely used in the medical field and industries for inspection of the human body or any other thing.

## Production of X-rays

X-rays can be produced with the help of a high vacuum tube with a heater, cathode, and anode. The vacuum tube operates at very high voltage. A special electron tube (vacuum tube) is shown in Fig No 11 which is used for the production of x-rays. Such a tube has a hot filament cathode and an anode made of a very heavy metal. Electron flow is from the cathode to the anode as in any diode tube. However, a large DC voltage is used between the cathode and anode of the x-ray tube.



**Figure 1: X-Ray Tube**

When heater is on and very high anode to cathode voltage is applied the electron emits from cathode and travel toward the anode with very high Velocity, as clear from figure 1, this beam of electron strike the metal anode such speed that new rays are made from the slanting surface of the anode these x-rays seem to bounce sideways ad out thought the well of the tube. As the DC voltage (anode-to-cathode of the x-rays tube) is increased, the wavelength of x-rays decreases. Same tubes now operate at more than a million volts.

## Block Diagram of X-Rays machine

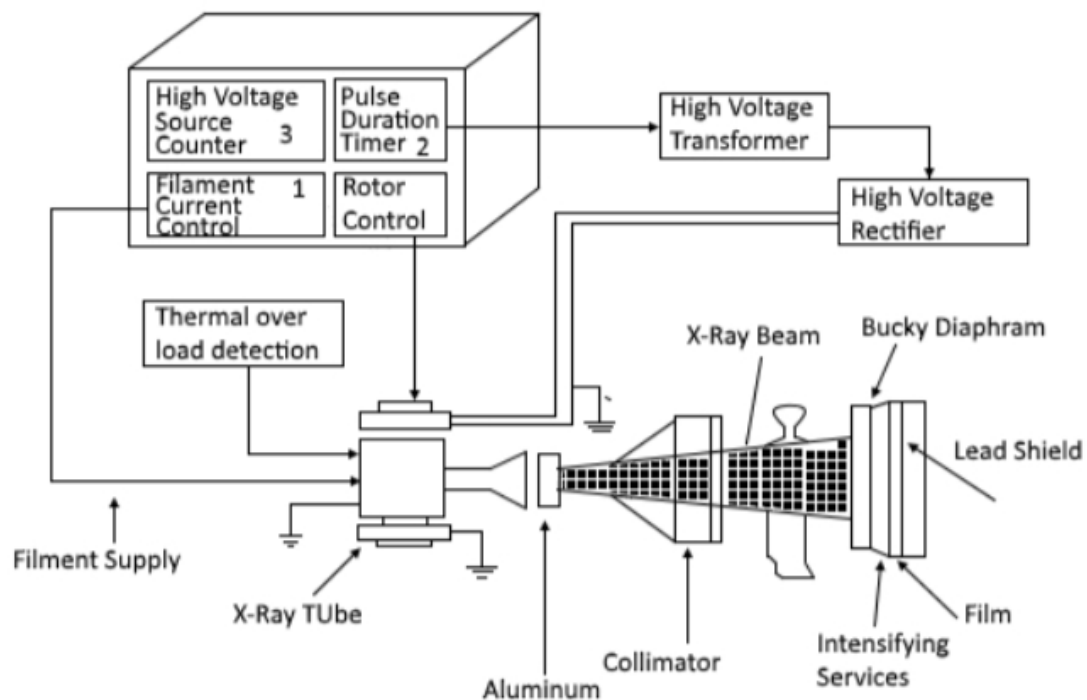


Figure 2: Block Diagram of X-Ray

## Operation/Working of X-Ray Machine

### High voltage source and high voltage transformer

High voltage source is responsible for providing high voltage to the H.V transformer for a decided time. The H.V transformer produces 20 KV to 200 KV at the O/P. These voltages are used to determine the contrast of the image. High voltages have higher contrast.

## High voltage rectifier

This rectifier rectifies the high voltage produced by the H.V.T and supplies them to the anode of the X-ray tube.

## Thermal overload detector

The heat of the X-ray tube (should not be increase by a specified range). If the heat is exceed from a specified value, and then the thermal over load detector is used to turn off system.

## **Rotor control**

Most of the X-ray tube anodes are rotated by an induction motor, in order to limit beam power at any spot and helps to cool the anode.

## **Pulse duration timer**

The duration of the time must be very small so that

1. The patient does not receive the excessive dose,
2. The film does not become over exposed.
3. The X-ray tube does not over heat. The pulse duration timer determines this pulse duration.

## Aluminum Filter

The X-ray beam used in the medical field which contains a broad band of frequencies.(1) The unwanted frequencies in the x-ray based create side effects e.g extra dose for patient causing tumor also reduce the contrast in the image. These are called soft x-ray. To eliminate these effects Aluminum filter is used.

## Collimator

Another mean to reduce the dose of patient is to confine the x-ray beam only on the region of interest on the body of patient. An external collimator placed between patient and filter does this.

## Diaphragm

X-rays inside the patient create x-ray scattering, which tends to burned the image to absorb the scattered x-rays and eliminate the burning of an image a lead grid is used which is called diaphragm.

## Film and lead shield

The x-rays passed from the desired region of the patient body are made to strike on the film where they produce an image of the body soft and hard parts. A lead shield is use to collect the x-rays after striking on film.

The H.V. source produces high voltage supply, which are rectified by rectifier and applied to anode of the x-ray tube. Filament supply is also provided. As a result x-rays tube producing an x-ray beam which is passed through the body and produces image of body and the film, which is examined in laboratory.

## Application of the X-Ray

1. Detection of the fraction in bones.
2. Infection of lungs, kidneys and other injury.
3. Presence of Tumour.
4. X-rays are used for treatment for Tumour.

# Use of X-rays in industry

1. For industrial radiography and fluoroscopy.
2. For measuring the thickness of material.
3. Inspection of metals.
4. Inspection of fruits before packing.