X-ray

X-ray: is a part of electromagnetic spectrum with short wave length, high frequencies, high energy radiation, not all projected x-ray arrive at the film some are absorbed or deflected, the resistance to x-ray penetration is called radio density. In human body are increasicly in bone and lower in air.

The Feature of X-ray:

1. It has the ability to penetrate material with different degrees of energies except lead.
2. nonvisual spectrum wave.
3. The ionic effect: that it can be ionic atom of air.
4. The physiological effect: it can penetrate living tissues, such killing the red blood cell.
5. The photographic effect: it can be effective in photosensitive film.
6. The fluorescent effect: that it can be effect in crystal.
7. The useful range of wave length of x-ray
    - **For diagnostic(0.1-1A°) use in:**
      A-still picture (radiography): used to examine bones+ internal organs.
      B-Continuous picture (fluoroscopy): used to examine organ system such as function.
      C- Motor picture (angiography): used to examine circulator systems.
      d- Still picture x-ray scans (tomography): used to examine bones + organs + tissues from many different angles.
    - **For therapist purpose (0.1-100A°):** using for killing and remove the cancer cell.

Principle of work:

Work of x-ray device depends on:

- X-ray absorbed or deflected such as pass through the body.
- Project x-ray arrive at the film, in the human body, air has lowest radiodence, fat, liver ,blood ,muscle and bone are increasicly radiodence,the result an image in which radiodence tissues are in shade of gray to black.
- If the organ that examiner not containing bone then x-rays technique done by giving the patient barium solution that is causes the contours of organ such as gastric and intestinal lining to appear white.

Components of x-ray machines

1- **High tungsten transformer (1mf):** using for raise voltage-250 kV. It's connected directly with tube by cable transmitted in it a large amount of power.
   - Property of transformer:-
     a- High voltage
     b- High frequency
     c- Low current

2- **X-ray tube:**

X-ray produced whenever high–speed electrons are suddenly brought to rest. This is done by accelerating electrons in an electric field between two electrodes. The kinetic energy of the accelerated electrons is converted to three principle ways:-

a- Less than 1% into x-ray.
b- 98% into heat.
c- Some electrons producing heat, x-radiation.

The requirements of the x-ray tube:

1. Source of electrons (cathode), consisting of:

A-focusing cap of nickel to focus the electron to the target.

B-filament of fine tungsten wire coiled to form spiral, mounted within the focusing cup.

- Big filament (24v) (for giving electron).
- Small filament (12v) (for spiral).

2- Energy to accelerate the electrons (potential different across the tube by high –tension transformer).

3- Free electron path (vacuum).

4- Device to stop the electron beam (anode) &there are two types of anode:

-Fixed type: made of cylindrical block copper. Its face inclined at angle (20°).when power target in it with high voltage in one face cause to corrode.

- Rotating type: it solve the corrode problem, it's a disc of tungsten with beveled edge.

5- Envelope glass: made of heat resisting glass.

6- shield: is made of steel sheet or aluminum, lined with a thin sheet of lead.

7- oil: put in the space between the tube and the shield, the function of oil:

1- Has good insulating
2- Cooling properties
3- Cool off the spiral.

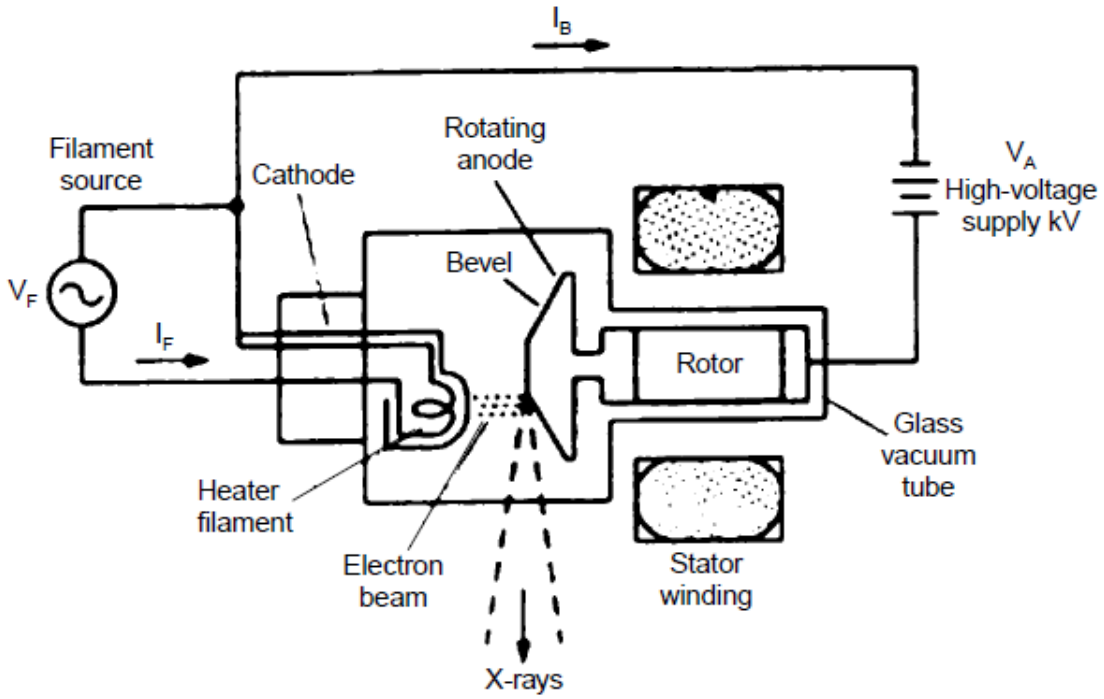

Fig.1 Shows an X-ray tube using a rotating anode.

3-Hand switch: used for switching and determining the contours of image in photosensitive film, using in two cases:

A- Ready at once.

B- Exposure timing switching.

The range of voltage that is using, for teeth (7-10v), for palm of hand (10-15v), for arm (15-20v), head (20-30v), chest (30-40v), so 1000 for total body.

4- **Control switch:** consist of three gages, every one connecting to fuse and light lamp for indication to work.

- Kilo voltage control.
- Milliamp gage control.
- Timer.

5- **Filters:** for absorbed the increasing x- ray wave.

6- **Bedstead:** used for setting the patient on it, its made of material absorbed x-ray wave containing:

a) Cassette: it's found under the body of patient containing the photosensitive film .its made of three types of materials plastic, aluminum, fiberglass.

b) Photosensitive film: to show the image giving by x-ray scan, its more than one type and size (8×12cm, 12×18, 24×18, 14×14, 17×14, 30×40 cm), the film should not be displayed to light.

☒ There are two types of bed (fixed in earth, movement bed).

7- **Low tension transformer:** it's connecting directly with control switch (low voltage, high current, low power.

8- **Electrical parts:**

-Two types of fuse (a-glass, b-pottery) the value of fuse (5A, 10A).

-switch on/off, changeable resistance (using for change between ms, kV, t), & relay.

-heating resistance: using for carrier high temperature that is resulting from electrons movement and for reduce heat use heat sing.

9- Acid: for showing the image and display in film after washing and using silver bromide for fixed the image in film.

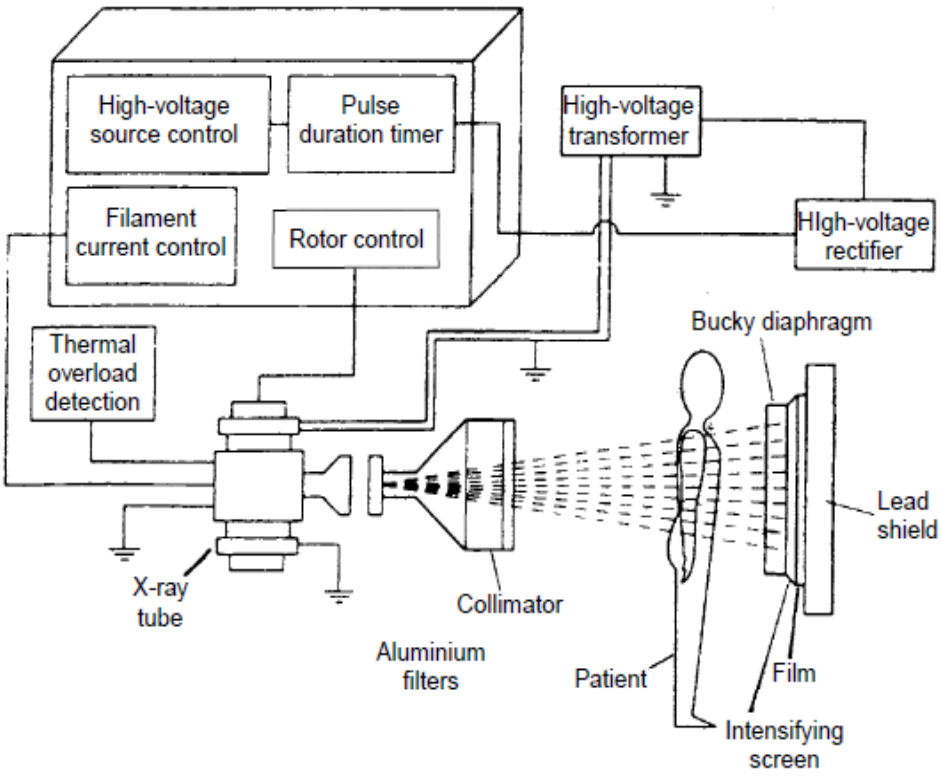

Fig. 2 shows a block diagram of an X-ray machine

- The collimeter: used for focus &controlled the image.
- Pulse duration: control the time of current.
- Current control: determine the density of image.
- Voltage control: determine the contruse of image.
- Intensity screen: using for clear & contrast of image, consist of material with high atomic weight using for reflected &deflected the x-ray wave in phosphore layer.
- Using phosphore in layer of film because the film sensitive for light not x-ray radiation because the phosphor layer converted x-ray radiation in to photons.
- After 50,000-60,000 image then filment is dameged.

Daily maintenance

1-check up the connection cable between the source of voltage and device.

2-check up the fuse.

4-check up of fitment.

5-make sure that the acid used for showing image is not bad and used right procedure.

Faults and maintenance

- contrast of image is bad because
    1. Not give enough voltage for exposure of x-ray.
    2. The cables connection of high tension does not examine.
    3. Damage in filament.
    4. Defect in cassette of film.
    5. The film doesn't focus exactly under the patient.
    6. Bad acid using for showing image.

- **Maintenance**

  -examine every connection.
  -repair any part that is damage or defect.
  -give effective voltage for wave.
  -focus film under patient.
  - using good acid for showing image.

☒ The image dose not display:

1. Damage in filament (24V).
2. Damage in hand switch.
3. The given voltage for exposure of x-ray is not enough.
4. The cable of high tension is not connecting.

5. Fuse is damaged.
6. Wire of hand switch has been cutting.
7. The gage of kV, ms, T are damaged.

☒ The display is black image because:

1. High voltage is given (result from second filament).
2. The small filament (12v) has been damaged.
3. Damage in gage of kV, ms, T, or fuse.