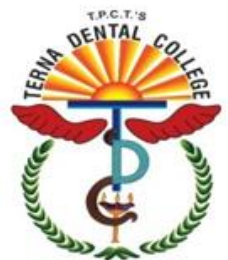


LECTURE TITLE

CONSTRUCTION OF XRAY TUBE -1

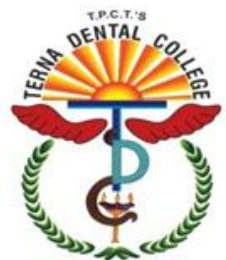


LEARNING OBJECTIVE

TO UNDERSTAND THE CONSTRUCTION OF XRAY machine

.

to understand the various parts and functions of each.

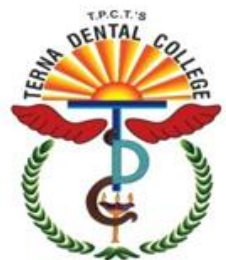


CONTENT

Introduction

PARTS OF XRAY MACHINE

1. CONTROL PANEL
 2. EXTENSION ARM
 3. TUBE HEAD
- XRAY TUBE
 - CATHODE
 - ANODE



INTRODUCTION

1. GAS TUBE OF ROENTGEN

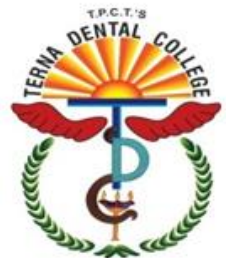
Residual gas in the tube .

Anode – Glass end of tube .

2. MODERN X-RAY TUBE- COOLIDGE TUBE

Cathode – Tungsten filament .

Anode – Tungsten & copper stem .

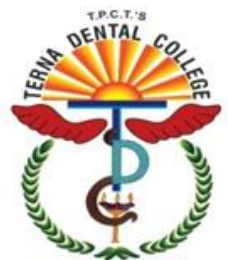


THE DENTAL X-RAY MACHINE

CONTROL PANEL

EXTENSION ARM

TUBE HEAD

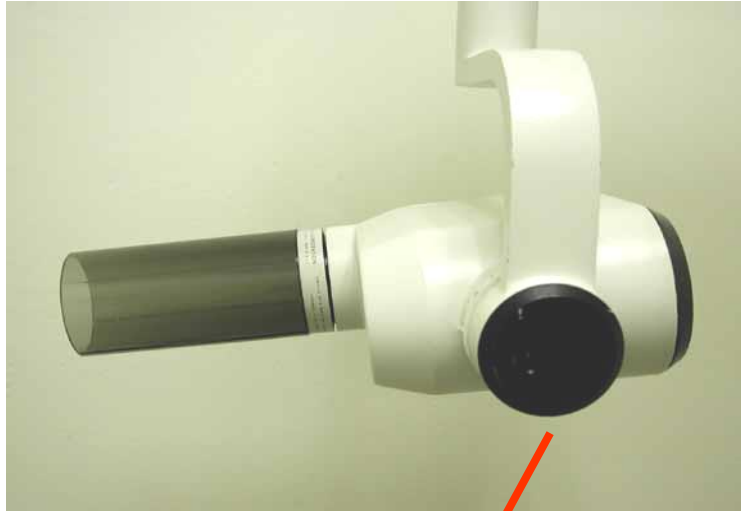


CONTROL PANEL

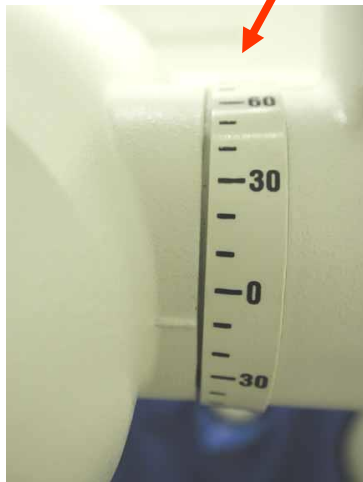
ON-OFF SWITCH
EXPOSURE BUTTON
CONTROL DEVICES
for time, kilovoltage,
milliammeter.

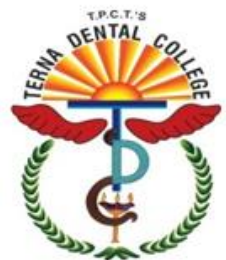
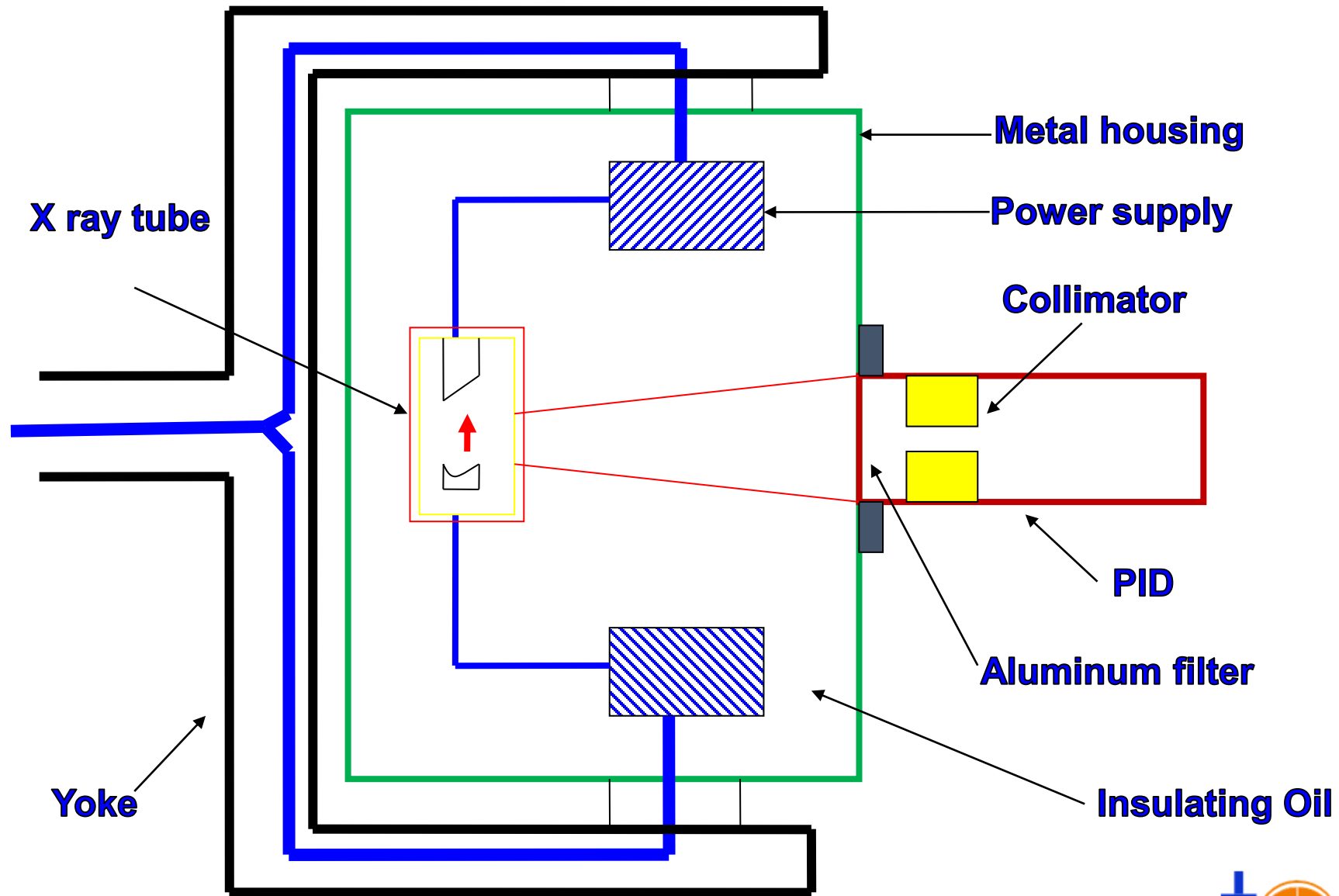


TUBE HEAD



- Metal housing
- Insulating oil
- Tube head seal
- X-ray tube
- Aluminium disks
- Lead collimators
- Position indicating device





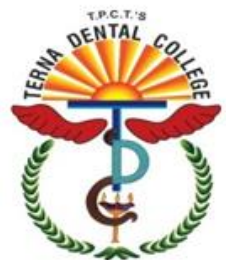
METAL HOUSING

Containing, supporting & protecting the x-ray tube, transformer & oil.

Protects the operator from electric shock by earthing.

Radiation protection of user & patient.

LEAD



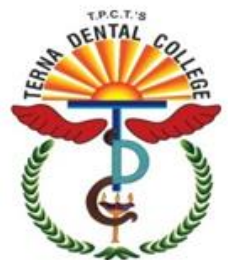
INSULATING OIL

Cooling of target.

Electrical insulation.

Metal bellows

Microswitch

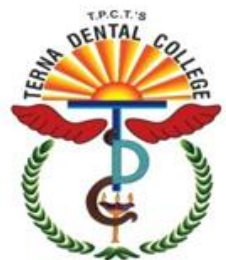


TUBE HEAD SEAL

Al or lead glass of the tube head that permits the exit of x-rays from tube head.

Seals the oil in the tube head .

Acts as a filter.



THE X-RAY TUBE

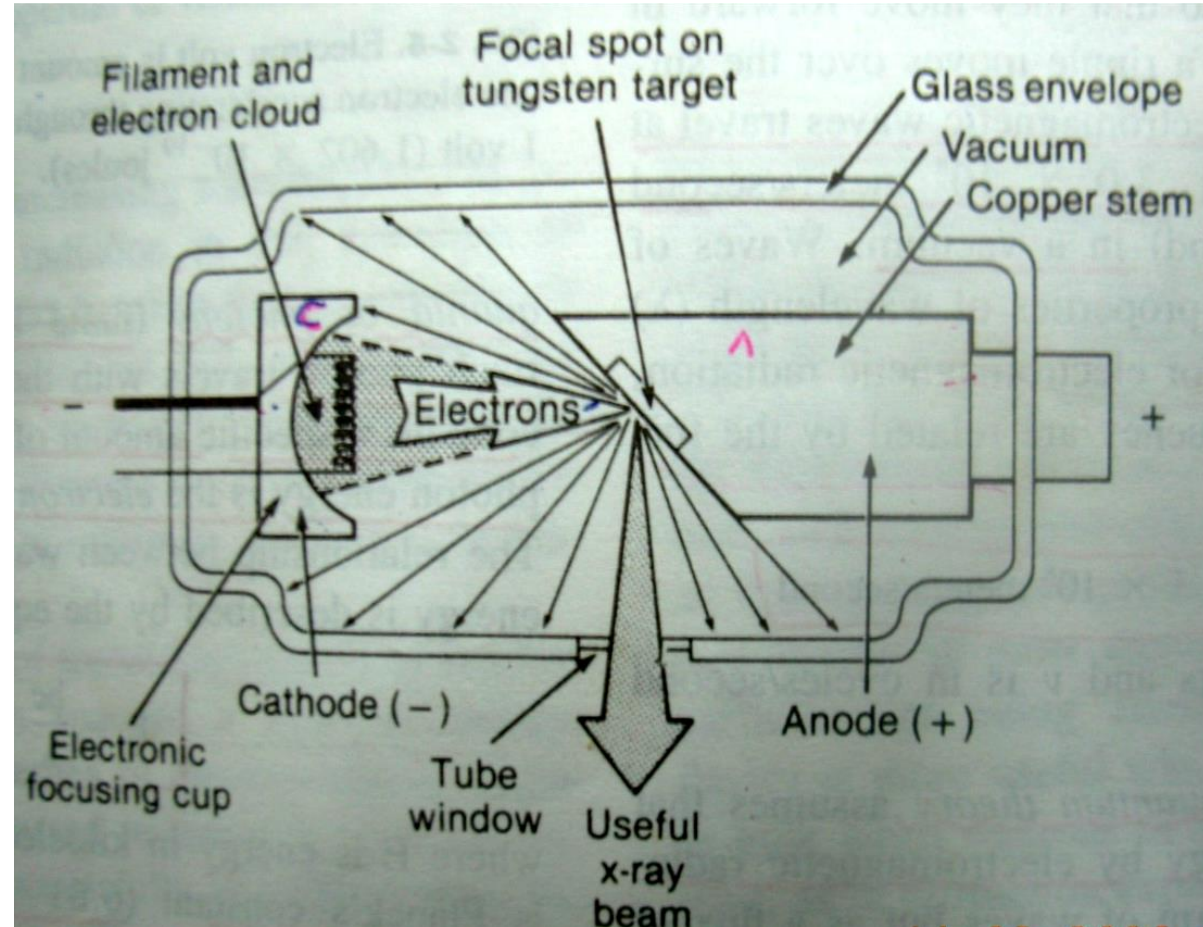
Leaded glass housing.

Negative cathode

1. Filament.
2. Focusing cup.

Positive anode

1. Stationary.
2. Rotating.

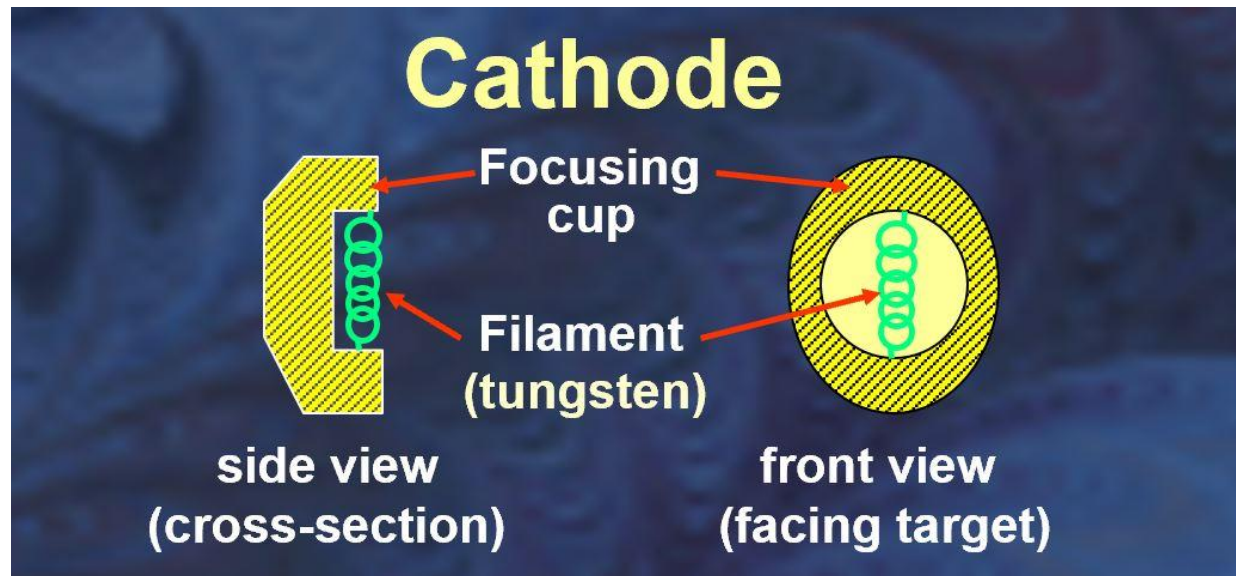


THE FILAMENT

Consists of tungsten wire 0.2 mm in diameter.

The coil is 0.5 to 1mm in diameter & less than 1cm long.

Mounted on 2 strong wires connected to low & high voltage circuit.

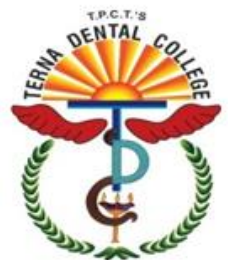


WHY TUNGSTEN

High atomic number - 74

High melting temperature – 3380°C

Low vapour pressure.

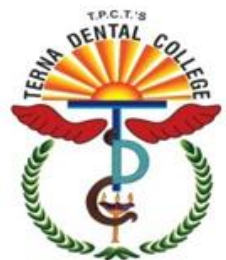


The low voltage circuit has a Step down transformer which heats the filament causing 'thermionic emission & formation of electric cloud.

Electrons lost are replaced from negative side from high voltage circuit.

Thus the filament acts as a source of electrons.

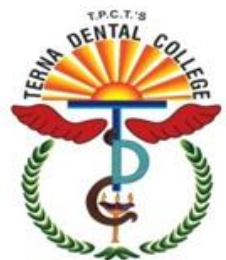
A milliampere control provides for fine adjustment of the voltage across the filament.



THE FOCUSING CUP

The filament is located in a –vely charged concave focusing cup of molybdenum.

It electrostatically focuses the electrons emitted by the filament into a narrow beam directed at a small rectangular area on the anode called the focal spot.



SPACE CHARGE

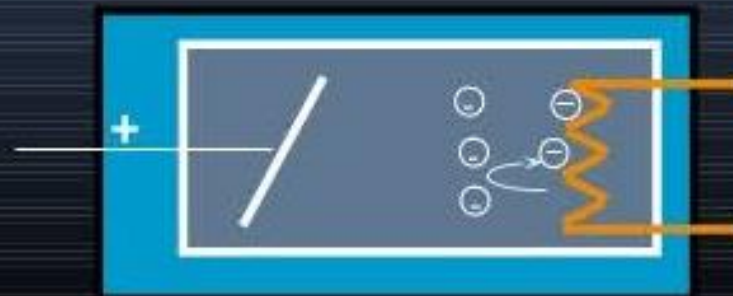
Electrons leave filament

- filament becomes positive
 - Negative electrons stay close

Electron cloud surrounds filament

Cloud repels new electrons from filament

Limits electron flow from cathode to anode

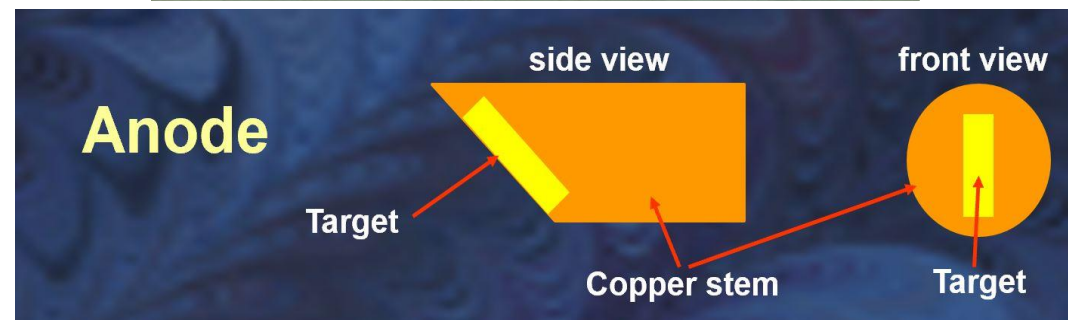
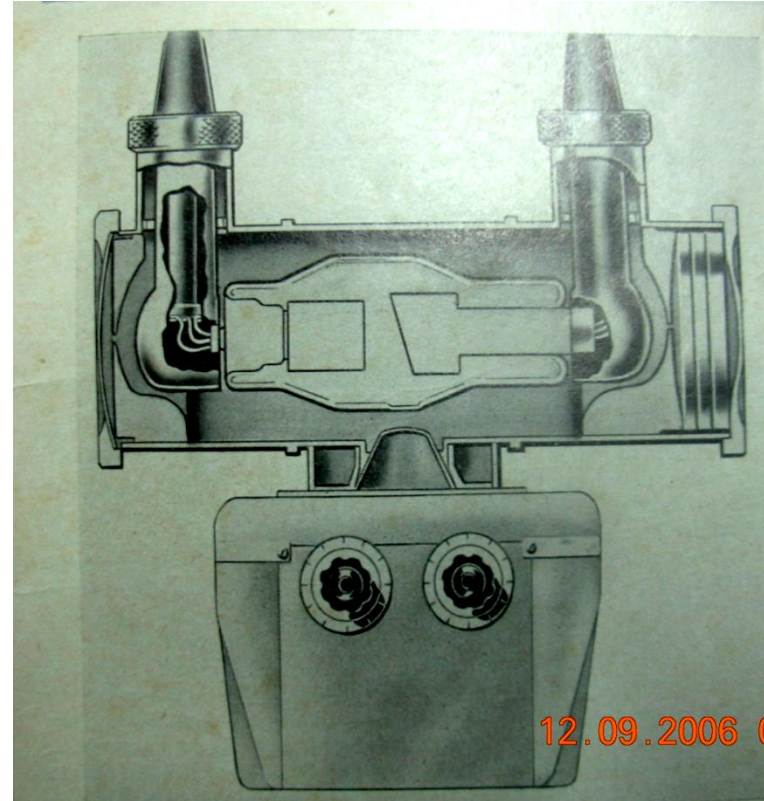


NEGATIVE ANODE

A tungsten target in the form of a square or rectangular shape about 2-3mm thick & greater than 1cm dimension.

A copper stem.

Converts the kinetic energy of the electrons into x-ray photons.



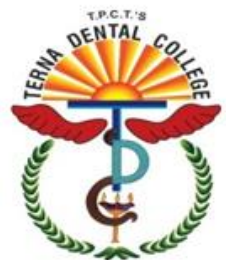
Tungsten is selected as the target material because of

- High thermal conductivity

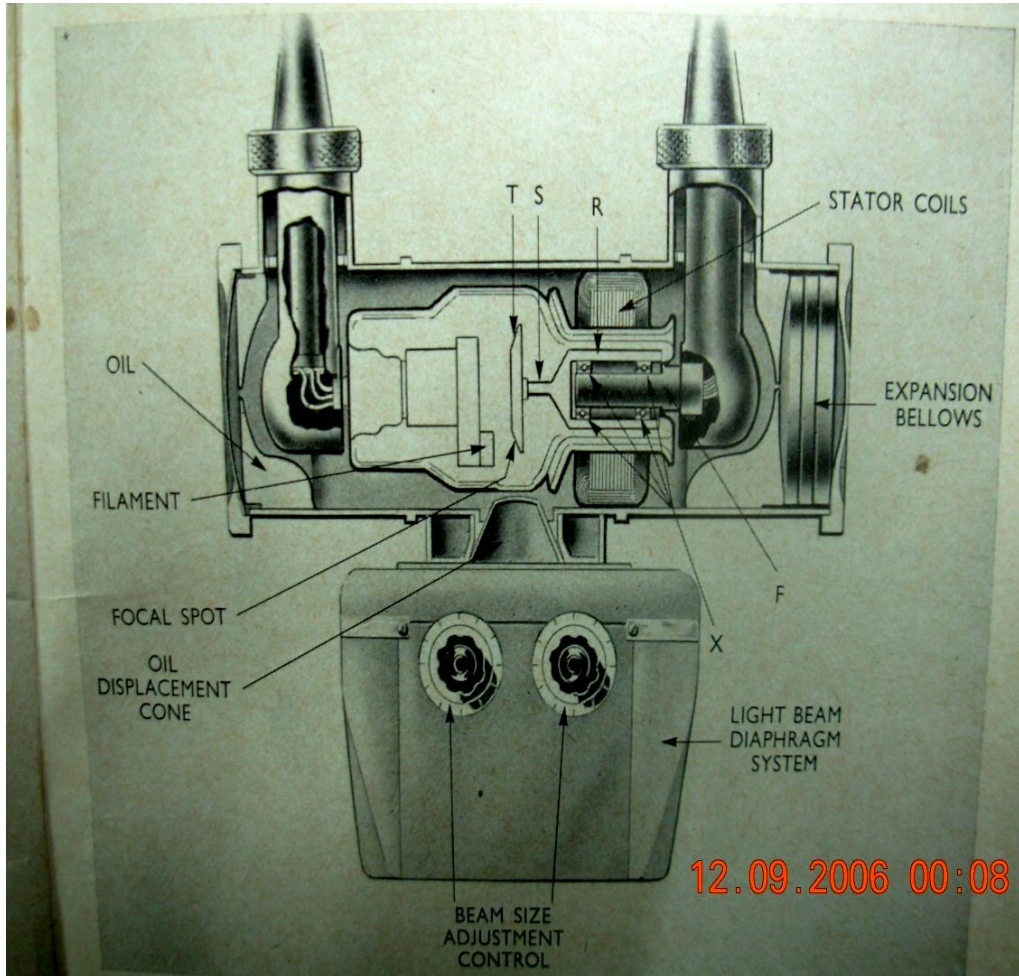
- High melting point.

- Low vapour pressure. – maintains the vacuum in the tube at high operating temperatures.

Copper serves as a good thermal conductor to dissipate heat from the tungsten target.



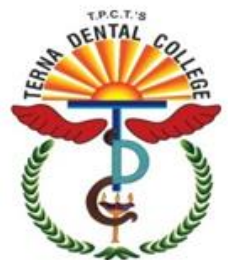
ROTATING ANODE



- Beveled disk of tungsten (T) 7.5-10cm in diameter & 6-7mm in thickness.
- The target & the rotor (R) of the motor are located within the x-ray tube whereas the coil which drives the rotor at about 3600rpm are situated outside the tube.

Methods of heat dissipation

- Conduction : copper stem.
- Convections : oil surrounding the tube.
- Radiation : radiator device attached to copper stem.
- Rotating anode.



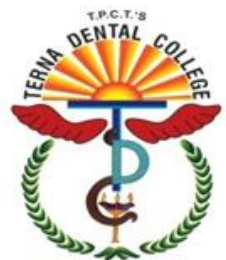
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Essentials of oral and maxillofacial radiology- Freny karjodkar.

Textbook of dental radiology 3rd edition – pramod john R.

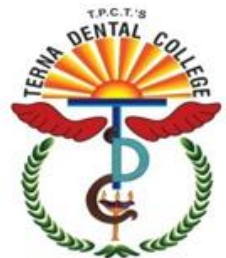
Essentials of dental radiography and radiology – eric whites.



CONCLUSION

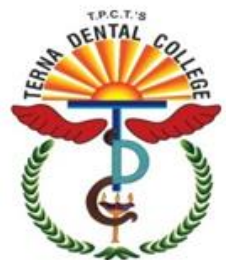
Construction of x-ray tube is very important in understanding how the x-rays are produced.

With this knowledge we can put to use the best of properties of radiation.



TAKE HOME MESSAGE

Learning x-ray machine helps in better understanding of the production of x-rays.



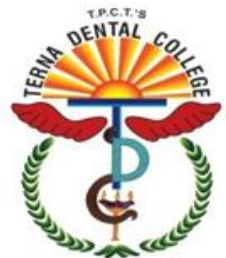
PROBABLE SAQS AND LAQS

SAQs

Write short note on CATHODE

Write short note on ANODE.

Draw a neat labelled diagram of xray tube.



PROBABLE SAQS AND LAQS

LAQs

Describe the xray tube in detail with diagrams.

