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Q1.What do you know about Operating Console and High voltage generator of the X-ray imaging system?Explain.

ANS. ***The Operating Console:***

This is the part of x-ray imaging system most familiar to the radiologic technologist because it allow us to control the x-ray tube current and voltage so that the useful x-ray beam is of proper QUANTITY (the number of x-rays or the intensity of the x-ray beam and expressed in milliroentgens [mR] or milliroentgens/milliampere-seconds [mR/mAs]) and QUALITY (refers to the penetrability of the x-ray beam and expressed in kilovolt peak [kVp] or more precisely called the half value layer.) Operating consoles has an on / off control and controls to select kVp, mA, and time or mAs. Furthermore, operating consoles usually provides for control of line compensation, kVp, mA and exposure time. Meters are provided for monitoring kVp, mA and exposure time. In modern consoles that incorporate AEC have a separated controls for mAs. The AEC is also found in operating console.

Digital Operating Consoles:

Most Operating Consoles are based on computer technology. Controls and Meters are digital and techniques are selected with

touch screen. Numerical technique selection is sometimes replaced by icons indicating body part, size and shape. Many of the features are automatic, but the radiologic technologist must know their purpose and proper use.

Safety Features Operating Consoles for Radiologic Technologist:

All the electric circuits connecting the meters and controls on the operating console are at low voltage to minimize the possibility of hazardous shock. A simplified wiring connections for a typical operating is installed. Most operating consoles are computer based technology. Controls and meters are digital, and techniques are selected with a touch screen. Numerical techiques selection is sometimes replaced by icons indicating body part, size, and shape. Many of the features are automatic, but the radiologic technologist must know their puppose and proper use.

High Voltage Generator:

The High Voltage Generator of an x-ray machine is responsible for increasing the output voltage from the auto transformer to the kVp necessary for x-ray production. On High Voltage generator, some heat is generated in the high voltage section and is conducted to oil. The oil is used primarily for electrical insulation. The high-voltage generator may be housed in an equipment cabinet positioned against a wall, and it is always close to the x-ray tube, usually in the examination room. A few instalations take advantage of false ceilings and place these

generators out of sigh above the examination room. For newer generator designs that use high-frequency circuits require even less space in the examination room.

Q2. Write a note on the External Components of the X-ray tube.

ANS.

The External Structure of the X-ray Tube:

The x-ray tube and housing assembly are quite heavy, and therefore require a support mechanism so that the radiologic technologist can position it.

Ceiling Support Systems:

Cieling Support System (Del Medical) The ceiling support system is probably the most frequently used. It consist of 2 perpendicular sets of ceiling-mounted rails. This allows for both longitudinal and transverse travel of the x-ray tube. The ceiling support system has a telescoping column attaches the x-ray tube housing to the rails, allowing for adjustment of SID (Source-to-image receptor distance).

Floor-to-ceiling Support System:

The Floor to ceiling support system has a single column with rollers at each end, one attached to a ceiling mounted rail and the other attached to a floor mounted rail. The tube slides up and down the column as the column rotates. A varation of this type of support system has the column positioned on a single floor support system using one or two floor mounted rails.

C-arm Support System:

Interventional radiology suites often are equipped with C-arm support systems, so called because the system is shaped like a letter “C”. These system are ceiling mounted and provide for very flexible x-ray tube positioning. The image receptor is attached to the other end of the C-arm from the x-ray tube. Variations called L-arm or U-arm support are also common.

Protective Housing:

The Protective Housing guards against excessive radiation exposure and electrical shock. When x-rays are produced, they are emitted isotopically, that is with equal intensity in all directions. We use only those emitted though the special section of the x-ray tube called the window. Those x-rays emitted through the window are called the useful beam. The protective housing incorporate specially designed high-voltage receptacles to protect against accidental electrical shocks. Death by electrocution was a very real hazard to early radiologic technologist. It also provides a mechanical support for the x-ray

tube and protects the tube from damage caused by rough handling.

Glass or Metal Exposure:

An x-ray tube is an electronic vacuum tube with componets contained within a glass or metal enclosure. The glass enclosure is made of Pyrex glass to enable it to withstand the tremendous heat generated. The Metal enclosure tubes maintains a constant electric potential between the electrons of the tube current and enclosure. The enclosure maintains a vacuum inside the tube to allow more efficient x-ray production and longer tube life. Usually all current high-capacity x-ray tube use metal enclosures.

Q3. What are the three functions that anode serves in an X-ray tube?

Ans:

functions of Anode in X-ray Tube:

It is an electrical conductor for x-ray tube
The electrons received that emitted from the cathode and conducts them through the tube to the connecting cables and back to the high voltage generator.
It provides mechanical support for the tungsten target.

Target of X-ray Tube:

The target is the area of the anode struck by the electrons from the cathode. In stationary anode tubes, alloying the tungsten

(usually with rhenium) gives it added mechanical strength to withstand the tress of high speed rotation. High capacity x-ray tubes have molybdenum or graphite layered under the tungsten target. Both molybdenum and graphite have lwer mass density than tungsten, making the anode easier to rotate.

Rotating Anode:

The rotating anode x-ray tube allows the electron beam to interact with a much larger target area, and therefore the heating of the anode is not confined to one small spot as in stationary anode tube. The rotating anode tube provides nearly 1000 times more area to interact with the electron beam than a stationary anode tube. Higher tube currents and shorter exposure times are possible with the rotating anode. Heat capacity can be further improved by increasing the speed of anode rotation. The speed of rotation on most rotating anodes is 3400 rpm (revolutions per minute). The anodes of high capacity tubes rotate at 3400 rmp and 10,000 rpm.

Induction Motor:

An electromagnetic induction motor is used to turn the anode. An induction motor consist of two principal parts separated from each other by the glass or metal enclosure.
Stator – It is the part outside the enclosure and consist of a series of electromagnets equally spaced around the neck of the tube.Rotor – a mechanism that is located inside the glass enclosure and a shaft made of bars of copper and soft iron

fabricated in one mass.
The induction motor works through electromagnetic induction, similar to a transformer and based on Lenz’s law of induced currents.