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What are the two main parts of the x-ray tube

The construction of the x-ray tube head assembly is initially explored. The x-ray tube is housed in a protective lead-lined metal structure, providing solid mechanical support while also serving as an electrical insulator and thermal cushion (Figure 5-2). Since x-ray production is inefficient and generates significant heat, the housing incorporates an oil bath and cooling fans to dissipate heat away from the tube. The tube is immersed in the oil bath, which draws heat away, while the cooling fans circulate air around the assembly to further dissipate heat. Due to the high current and voltage required for x-ray production, electrical insulation is necessary; two large cables enter the housing and securely attach to the x-ray tube through special receptacles. Although x-rays appear to travel in one direction, they are produced isotropically, and the housing absorbs most photons traveling in other directions, reducing leakage radiation to less than 100 mR/hr. Two notes of caution: the housing can become hot with extended "on" times, and high-voltage cables should not be used as handles, posing a risk to radiographers and equipment. The general-purpose x-ray tube is an electronic vacuum tube consisting of an anode, cathode, and induction motor encased in a glass or metal enclosure (envelope) (Figure 5-3). The X-ray tube's internal environment plays a crucial role in its performance. If air were present within it, electrons from the air would be drawn into the electron stream, causing arcing and damage to the device. The glass envelope type is typically made of borosilicate glass due to its high heat resistance. However, over time, tungsten deposits on the inside of the glass can cause issues with arcing and damage. This problem does not occur in metal envelope varieties, which maintain a constant electric potential between the electron stream and enclosure, preventing arcing and extending tube life. Both types have a target window for x-ray exit points, designed to minimize interference with the rays produced. The components of an X-ray tube consist of two main parts: the insert mounted inside the shield and the light-beam diaphragm. Although inserts differ between rotating and stationary anode tubes, their shields share similarities in design and function. A suitable container is necessary for protecting patients and radiographers from electrical and radiation hazards posed by the insert while it's operational. This container, or shield, must satisfy various requirements, including providing sufficient radiation protection and housing a support system to hold the insert in place. The metal casing surrounding the insert is typically made of aluminum or steel and lined with 3 mm of lead for adequate radiation shielding. It's also filled with pure oil that acts as both an electrical insulator and coolant. A neoprene diaphragm at one end allows for expansion when the oil heats up, and a microswitch usually prevents further exposures if the oil gets too hot. Within this casing is a radiolucent window – the tube port – which enables the useful beam to pass through, allowing x-rays to be produced safely. Inside the x-ray tube, radiation passes through the light-beam diaphragm. The production of x-rays is optimal when a vacuum exists between the cathode and anode, so these components are sealed within a strong metal or heat-resistant glass container that preserves this vacuum. When using a glass envelope, it's connected to the anode spindle at one end and the nickel cathode support at the other via re-entrant seals that reduce thermal stress on the glass during operation. The glass must be an effective electrical insulator to prevent excessive current flow but also have enough conductivity to allow charges built up inside it to dissipate between exposures, preventing static charge buildup. During operation, a thin layer of tungsten is deposited on the envelope's interior due to filament and target vaporization, acting as a radiation filter. In glass-enclosed tubes, this film may eventually cause electrical breakdown by acting as an internal conductor. To prevent this 'gassy' state, maintain short prep times and adhere to exposure ratings. Understanding x-ray tube components is crucial for professionals, given the device's significant role in diagnostic healthcare, producing black-and-white images of internal body structures. The X-ray Tube: A Comprehensive Overview May use harmful side effects if exposure occurs. Aluminium filter is employed to filter the unwanted radiations in an x ray beam. The helix is improved, thus enhancing image quality. Tungsten is typically used for the filament due to its ease of use, good thermionic emission, and high melting point of 3410 °C. Its low thermal expansion coefficient ensures minimal dimensional change when heated, while its low vapor pressure prevents significant tungsten vaporization. Adding 1-2% thorium to tungsten improves thermionic emission. X-ray tubes originated from Crookes tubes, with which X-rays were first discovered by Wilhelm Conrad Röntgen on November 8, 1895. An X-ray tube is a vacuum tube that converts electrical power into X-rays, enabling radiography and creating a controllable source of X-rays. These tubes are used in various applications, including CT scanners, airport luggage scanners, and material analysis. For an X-ray tube to function, a power supply is necessary to heat the filament and establish a high voltage potential between the anode and cathode. The tube consists of a glass envelope containing the anode and cathode, which provides support, electrical insulation, and maintains a vacuum. The cathode's primary function is to expel electrons and focus them into a beam aimed at the anode. The typical cathode features a small coil of wire, known as the filament, recessed within a cup-shaped region called the focusing cup. The filament is the electron source within the tube, consisting of a tungsten or nickel wire coil, 2mm in diameter and 1cm or less in length, mounted on two stiff wires that support it and carry the electric current. The filament is heated by the flow of current from the low-voltage source, emitting electrons at a rate proportional to its temperature. The focusing cup is a negatively charged, concave reflector made of molybdenum, designed to condense the electron beam into a small area on a focal track. • The anode serves as the primary component in generating X-radiation through conversion of electronic energy. • It is typically composed of metal with a high atomic number, such as tungsten, which allows for efficient heat dissipation and durability at elevated temperatures. • The effectiveness of the anode depends on factors like its material composition and the energy of electrons, significantly impacting X-ray tube efficiency. Key factors that influence x-ray production include specific electrical parameters. These three primary electrical variables can be adjusted: voltage (KV), which is the electrical potential applied to the tube; current (MA), the flow of electricity through the tube; and exposure duration (S), typically a fraction of a second. The circuit is analogous to an electron circulation system, where electrons acquire energy as they pass through the generator and transfer it to the x-ray tube's anode. A critical phenomenon affecting x-ray intensity is the anode heel effect. This occurs when photons produced deeper within the anode must first traverse its "heel," causing reduced intensity on that side before reaching the object or image receptor. This effect is utilized when imaging anatomical structures with varying thicknesses and densities along their lengths. The protective housing surrounding the x-ray tube provides dual protection against radiation and electrical hazards. It offers mechanical support, prevents damage, and includes features such as cooling fans to air-cool the tube. Additionally, it reduces radiation leakage and shields patients from electric shock.

Parts of x ray tube and its function. What are the parts of x ray tube. What are the two main parts of the x ray tube. What are the 3 parts of the x-ray tube.