SNS COLLEGE OF ALLIED HEALTH SCIENCES- COIMBATORE 35

DEPARTMENT : RADIOGRAPHY AND IMAGNG TECHNOLOGY

SUBJECT : GENERAL PHYSICS, RADIATION PHYSICS AND PHYSICS OF DIAGNOSTIC RADIOLOGY

PAPER : PAPER II (UNIT 5 – PHYSICS OF DIAGNOSTIC RADIOLOGY : X-ray TUBE)

TOPIC : 10. AEC, ABC

AUTOMATIC EXPOSURE CONTROL

- Phototimers terminate the exposure, when the X-ray receptor (film/ screen) receives a preselected amount of radiation.
- They use any one of the radiation detector, namely,
- (i) ionization chambers,
- (ii) solid state diodes, and
- (iii) scintillators with photomultiplier tubes.
- In addition, there is an amplifier, density selector, comparator circuit, termination circuit and a back up timer.

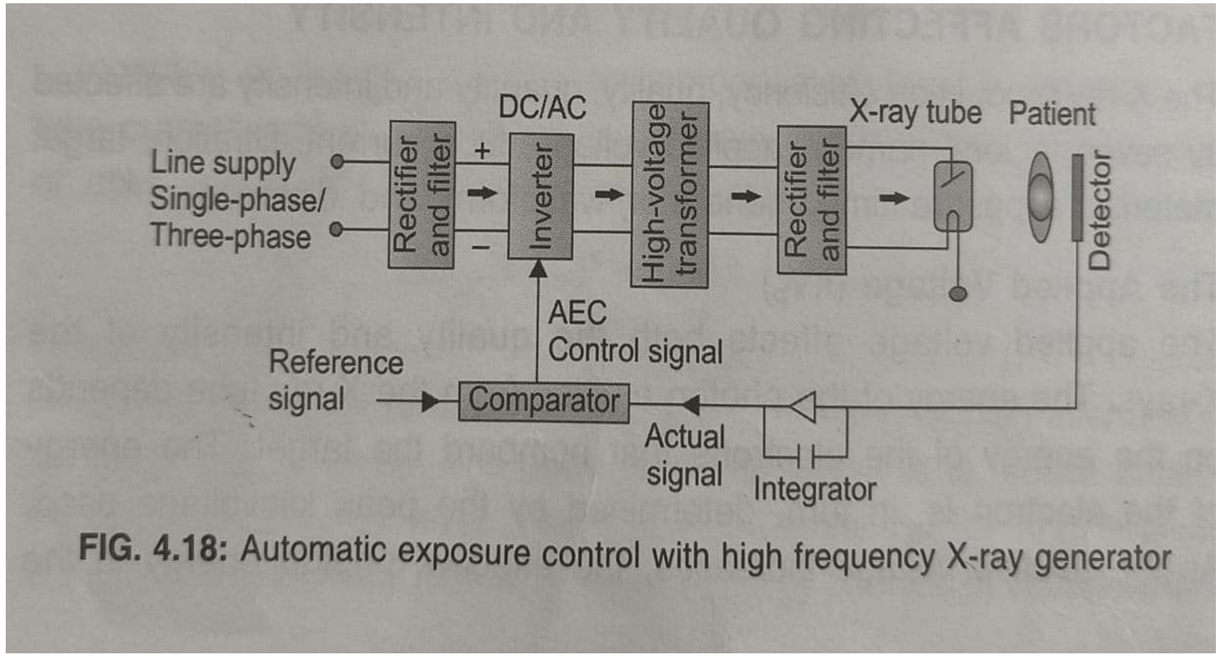

FIG. 4.18: Automatic exposure control with high frequency X-ray generator

AUTOMATIC EXPOSURE CONTROL

- The X-ray coming out of the patient falls on the ionization chamber which is amplified, which is fed to the comparator and integrator circuit.
- When the integrated signal is equal to the pre-selected value, the exposure is terminated. In case of failure, back up timer terminates the exposure.
- Most manufacturers use flat, parallel plate ionization chamber, which is mounted between the patient and the film. Since the chamber is radiolucent, it does not cause much shadow on the film.
- Solid state diodes and scintillators are mounted behind the cassette, to avoid their shadow on the film. A typical automatic exposure control (AEC)used in a high frequency generator is shown in Figure.
- In order to match the film speed to the signal collected by the photo timer, proper calibration is required.
- Nowadays phototimers are provided with multiple settings, so that X-ray exposure may be increased or decreased in 10-20% increments.
- This will enable the operator to vary the film density for a given patient imaging. This is the most common type used today, which eliminates human error.

AUTOMATIC BRIGHTNESS CONTROL

- In fluoroscopy imaging, if image intensifier moves from a thinner to thicker region of the patient, higher the amount of attenuation of X-rays.
- This will reduce the brightness of the output screen. Automatic brightness control (ABC) is a mechanism, which can keep the brightness of the image constant at the monitor.
- It is basically a feedback circuit, which measure the light intensity of the output screen or video camera signal. A photomultiplier or a photodiode is used to monitor the light output of the II tube.
- The corresponding changes will be feedback to the generator for adjustment. The generator will regulate the X-ray exposure rate incident on the input phosphor of the II tube, by changing the kV or mA automatically.
- In general, the brightness of the central area of the output screen is taken into account for adjustment. Brightness can be adjusted by both kV and mA, which has influence on contrast and patient dose, respectively.
- The three methods of adjustments are (i) change of KV at constant mA, (ii) change of mA at constant kV, and (iii) change of both kV and mA. If the II tube moves from thinner to thicker part of the patient, increase of kV may result in lower dose with lesser contrast. But, increase of mA may result in better contrast with higher dose.

AUTOMATIC BRIGHTNESS CONTROL

- Alternatively, the brightness of the image on the monitor can be adjusted by varying the gain of the TV system, which is called automatic gain control (AGC).
- This will result in increased image noise and unwanted radiation dose. Generally, mA is adjusted as a first step to obtain the input dose rate of II tube.
- If the current limit is reached, then kV is adjusted to get the input dose rate. Even it is not sufficient then, AGC option is used to adjust the video display brightness.

INTERROGATIONS

1. Define Exposure switches
2. What is ABC ?
3. What is the principle of AEC ?

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THANK YOU