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Exposure timers:

The number of X-rays that reach the image receiver is related to the current of the X-ray tube and the time during which the tube is activated. the timer circuit is separate from the other main circuits of the x-ray machine. It works to separate the voltages supplied to the tube

Gurad timer: It is present in every exposure process and works to stop the X-ray machine even if the exposure remains and this time is after 6 seconds from the beginning of the exposure.

There are five basic types of timing circuits, four of which are technical and one is automatic:

1- Mechanical timer.

2- Synchronous timers.

3- Electronic timers.

4- mAs timers.

5- Automatic exposure control timers.

1- Mechanical timer: The mechanical timer operates by clockwork. A preset exposure time is dialed by turning a knob that winds a spring. When the exposure button is depressed, the spring is released and unwinds. The time required to unwind corresponds to the exposure time. Mechanical timers are inexpensive but not very accurate.

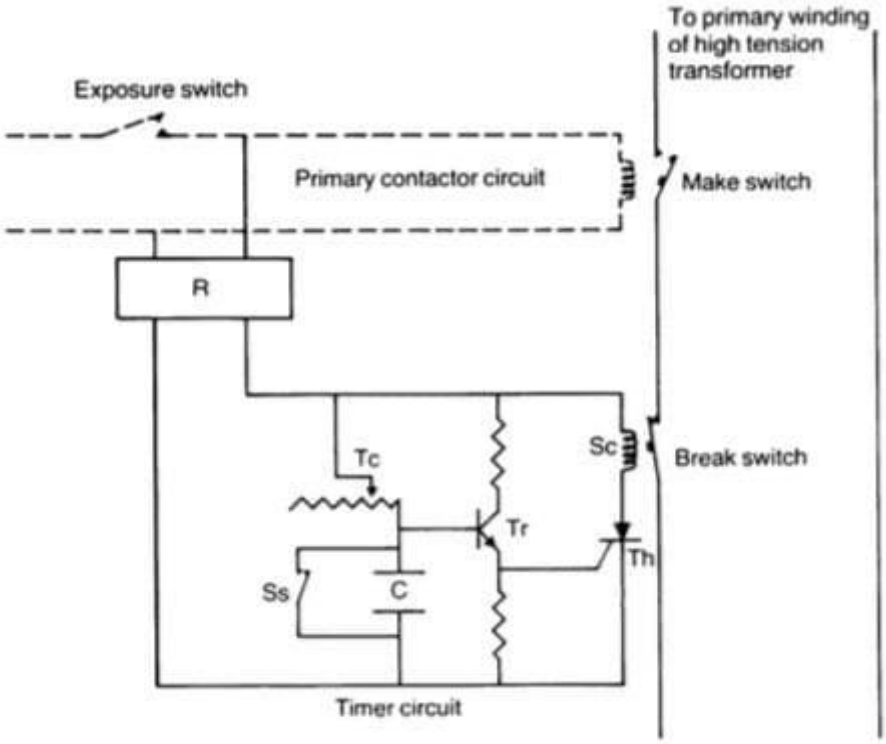
2- Synchronous timers: The current is provided with a frequency of 60 Hz for the imaging process, so that it provides the minimum exposure time

as it is a multiple of 1/60 sec or 17 milliseconds such as (1/30 s) (1/20 s). Where: T=1/f T: periodic time. f: Frequency

Devices that use this timer cannot make continuous exposure (sequential), as the device must stop after each exposure to configure it again to make a new exposure.

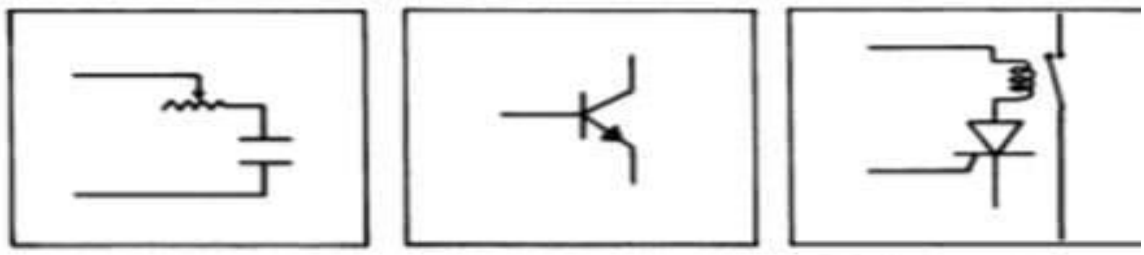
3- Electronic Timers

This timer operates on the principle that it takes a specific length of time to charge a given capacitor to a given voltage through a given resistor. From Figure (1) it can be seen that closure of the exposure switch completes the circuit through the solenoid of the primary 'make' contactor switch. Current now flows through the primary circuit and the X-ray exposure commences. At the same instant current begins to flow through the timer circuit and the capacitor begins to charge. When the voltage across the plates of the capacitor reaches a specified value, determined by the value of resistor selected, current to the base of the transistor initiates current flow in the collector circuit; this then triggers the thyristor which allows current to flow through the solenoid of the primary 'break' contactor. Current flow in the primary circuit is therefore stopped and the exposure is terminated. A switch shorts out the capacitor after the exposure and it remains closed until the unit is put into 'prep' ready for the next exposure. This ensures that the capacitor is always completely discharged at the beginning of an exposure. The length of exposure is determined by the value of resistor selected as this controls the time it takes for the capacitor to reach the critical stage at which it will switch 'on' the transistor. When equipment uses only one primary contactor switch to "make" and "break" the primary current the solenoid Sc in Figure (1) is used to open an interlock switch in the primary contactor circuit and thus terminate the exposure.



Tc – Timer control
Ss – Shorting switch (open when unit is put into 'prep')
C – Capacitor
Tr – Transistor
Th – Thyristor
R – Rectified and smoothed d.c. input
Sc – Solenoid coil of primary 'break' contactor switch

Figure 1 Simple circuit to illustrate principle of electronic timer



Capacitor begins to charge, through a resistor at the same instant that current flows through the 'make' primary contactor (exposure starts)

Transistor passes a trigger pulse to the thyristor when the capacitor reaches a critical voltage (time to reach this voltage is determined by the value of selected resistance)

Thyristor switches current to 'break' contactor (exposure ends)

Figure 2 Electronic timer drawn as a series of blocks

mAs timers: Special kind of electronic timer called an mAs timer, monitors the product of mA and time and terminates the exposure when the desired mAs is attained. It is set to the highest value of milliamperes and the highest possible time for the device to work. It is located in the middle of the secondary coil in a circuit (filament transformer).

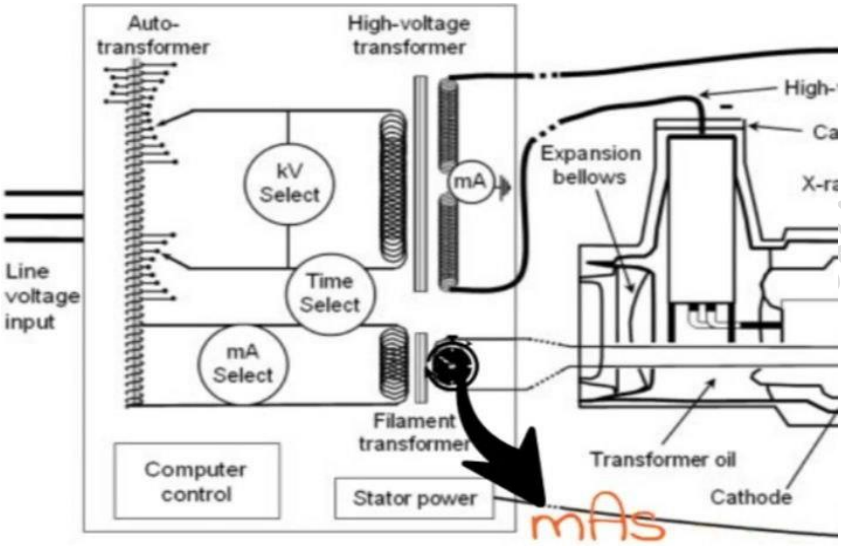


Figure 3 mAs timers

Automatic exposure control timers: is a device that measures the quantity of radiation reaching the image receptor and automatically terminates the exposure when sufficient radiation to provide the required optical density has reached the image receptor. There are two types of it :

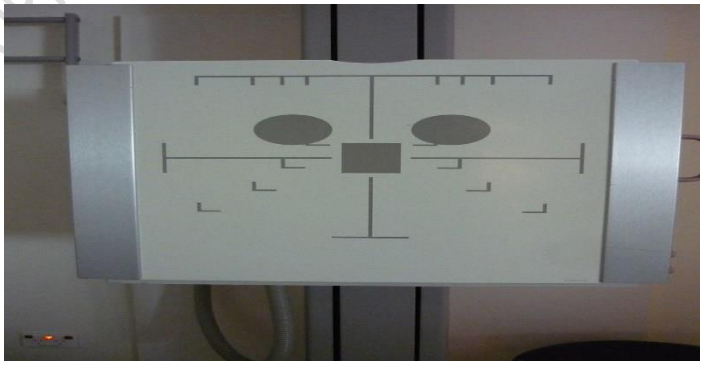


Figure 4 Automatic exposure control timers

Phototimers: It's made of silicon dioxide (Sio2) and sits behind a fluorescent (light-producing) screen which works to convert the rays coming from the patient's body into light, the photodiode converts this light into a signal by converting it into charges when the shipment quantity reaches the required limit. Here, the exposure time works to end exposure.

Ionization Chamber Systems: It is located between the patient and the X-ray receiver these ionization chambers are made of transparent radioactive material properties of this material absorb part of the incident rays the other part passes and xenon gas (Xe) is usually used to fill these chambers when the charge generated by the ionization process between radiation and xenon gas reaches the required limit, the exposure is terminated.

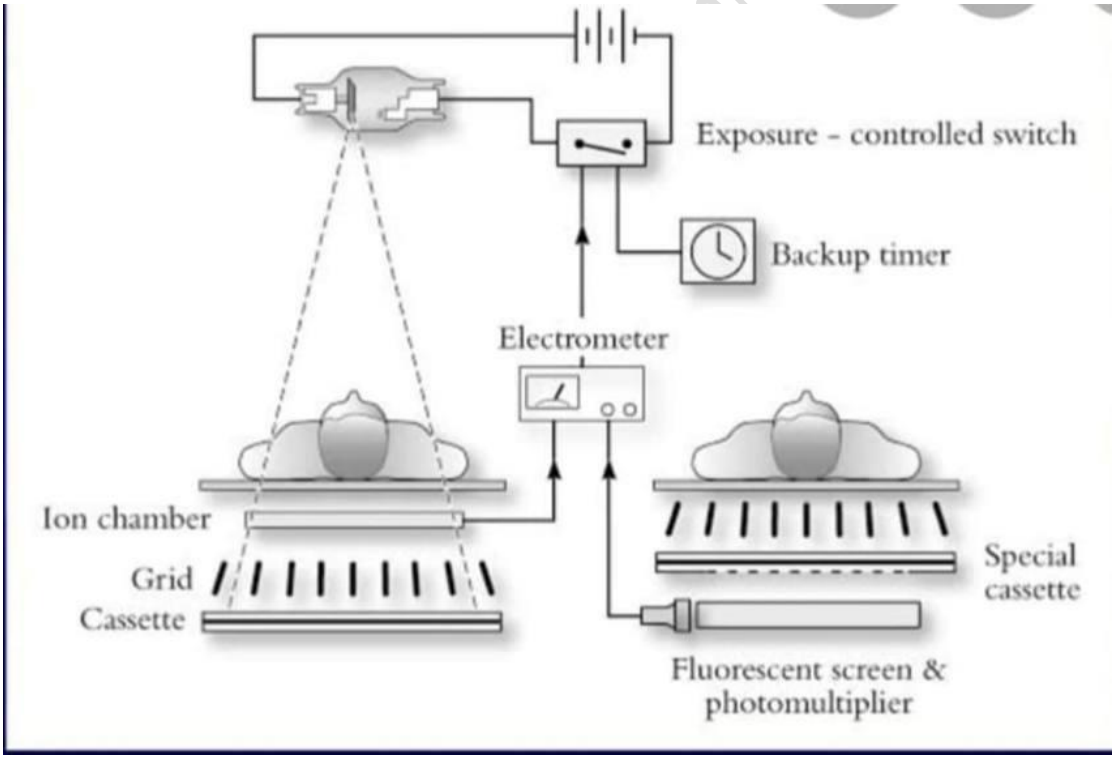


Figure 4 Phototimers