Electronics

January 22, 2021

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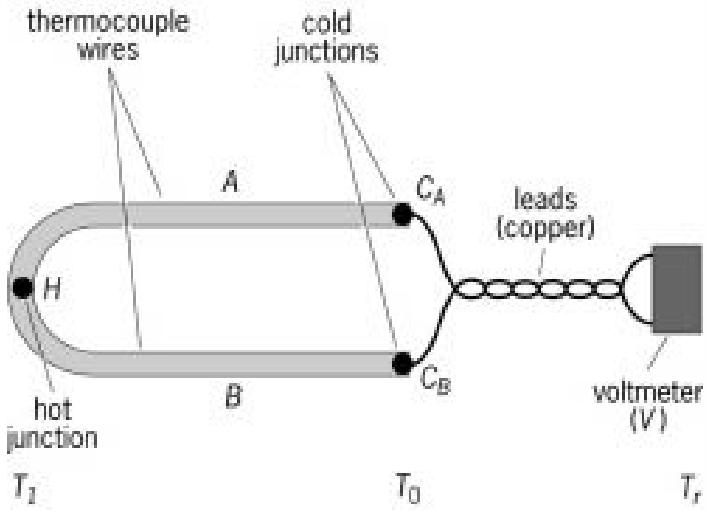

Figure 1.1: Basic circuit of a thermocouple

1. Electronic equipments used in patient care

Thermoelectric thermometer

- This temperature measuring instrument consisting of two wires of different metals joined at each end.
- One junction is placed where the temperature is to be measured, and the other is kept at a constant lower (reference) temperature.
- A measuring instrument is connected in the electrical circuit.
- The temperature difference causes the development of an electromotive force that is approximately proportional to the difference between the temperatures of the two junctions.
- Temperature can be read from standard tables, or the instrument can be calibrated to display temperature directly

Uses

- It is used for obtaining temperatures internally or on the surface of body.
- The unit is equipped with a variety of probes for obtaining temperatures.
- The thermionic thermometer offers greater accuracy than clinical mercury thermometer.
- It can be located up to 1,000 ft from the unit and registers the temperature in about 5 seconds.

Patient monitor

A patient monitor is an electronic medical device that consists of one of more monitoring sensors, a processing component(s), and a screen display (also called a "monitor") that provide and record for medical professionals a patient's medical vital signs (body temperature, blood pressure, pulse rate and respiratory rate) or measurements of the activity of various body organs such as ECG monitors, anesthesia monitors, or EKG monitors.

Working

- The transducer changes the physiologic information into electric energy, which is then passed through electronic circuits.
- These circuits amplify the electrical impulses and may transform them into mechanical energy in the form of a moving stylus that records the patient's pulse, temperatures, respirations and blood pressure on a graph.
- Other monitors are equipped to flash lights or ring bells if patient is exceeding certain physiological limits that have been programmed into the circuits

Uses

- Multi-parameter patient monitors support the conduct of patient care in doctors' offices, out-patient facilities, hospital operating rooms, hospital critical care facilities, and during EMS and non-emergency ambulance transport.
- There may also be a need for bedside measurement of vital signs in low-acuity post-anesthetic care and during sleep studies.
- Multi-parameter patient monitors provide the composite view required, at a glance. Many include configurable vital signs settings and both audio and visual comprehensive alarms.

Cathode Ray Oscilloscope

- The basic operation on which the instrument function is a stream of electrons that are liberated from a hot filament or cathode.
- The electron stream then passed through an anode at a high potential and strikes a fluorescent screen at the end of the tube.
- Whenever an electron strikes a fluorescent screen a spot of light appears.
- The electron stream is deflected from pursuing a straight path by an amplified current that is received from the part of the body under study.

Figure 1.2: A patient monitor

- This action current is connected to a pair of horizontal plates that deflect the electrons vertically and vice versa.
- The picture produced on the screen is a pattern of these deflections as the beam sweeps horizontally across the screen.
- The light pattern formed may be studied immediately or a photograph may be recorded for future study.

Electron microscope

- It depends upon the properties of electron for its operation. The ordinary microscopes cannot be used to view objects less than 0.000039 cm in diameter which is the same in magnitude as the shortest wavelength of visible light.
- Electrons possess a wave property similar to that of light waves. The wavelength emitted depends upon the voltage with which the electrons are accelerated.
- Under certain conditions the wavelength may be 0.05 Å. This is so much shorter than the shorter wavelength of visible lights (3,900 Å) that such minute objects as bateriophage particles have been seen with the aid of the electron microscope.
- The electron beam is provided by an electron gun. It contains an anode with a small opening to allow the electrons to pass through. The anode is grounded while the filament is at a negative voltage of 50,000 or more.
- There is also a doughnut-shaped coil of wire that acts on electrons like a convex lens, bending them on the object.

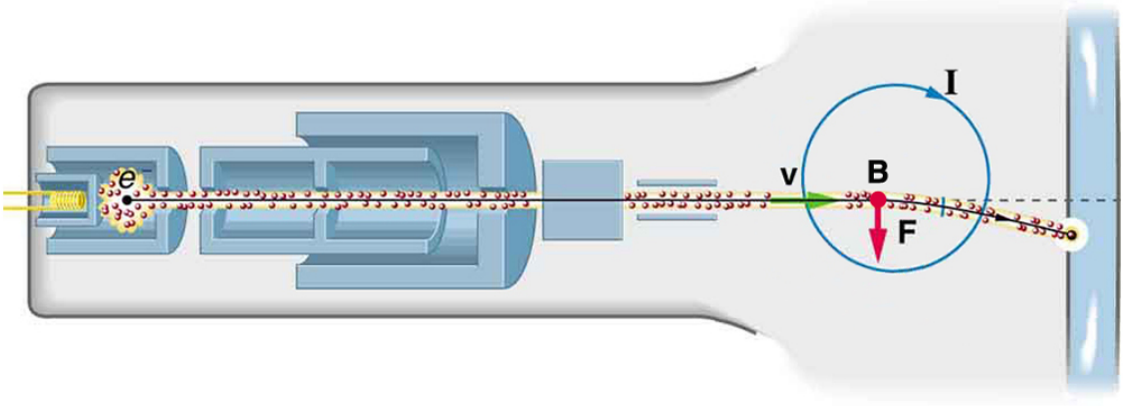

Figure 1.3: The cathode ray tube (CRT) is so named because rays of electrons originate at the cathode in the electron gun. Magnetic coils are used to steer the beam in many CRTs. In this case, the beam is moved down. Another pair of horizontal coils would steer the beam horizontally.

- The electrons beam is altered by the material by being stopped, retarded or scattered.
- The electrons beam is then passed through another electron lens that corresponds to the objective of optical microscope. A third lens magnifies the image that is then focused on a fluorescent screen where it may be seen or photographed.
- Difference between electron microscope and ordinary microscope: Stream of fast moving electrons instead of light rays. Coils of wire in place of lenses. A fluorescent screen or photographic plate instead of eyepiece.

Diathermy

- The passage of any electric current through tissues will cause heating. To obtain a significant amount of heat with ordinary low frequency currents it would be necessary to use large amount of current that the tissue would be destroyed.
- High frequency current however may be passed through tissues for a heating effect without causing damage.
- Diathermy is a means of producing heat in tissues of the body by use of high frequency electric currents.

Uses

- Diathermy has been reported effective in traumatic and inflammatory conditions of the skeleton for relief of bronchitis and pain of pleurisy.
- Ultra-high frequency diathermy may be used for inducing fever. This reaction known as electropyrexia is of value in the treatment of general paresis.

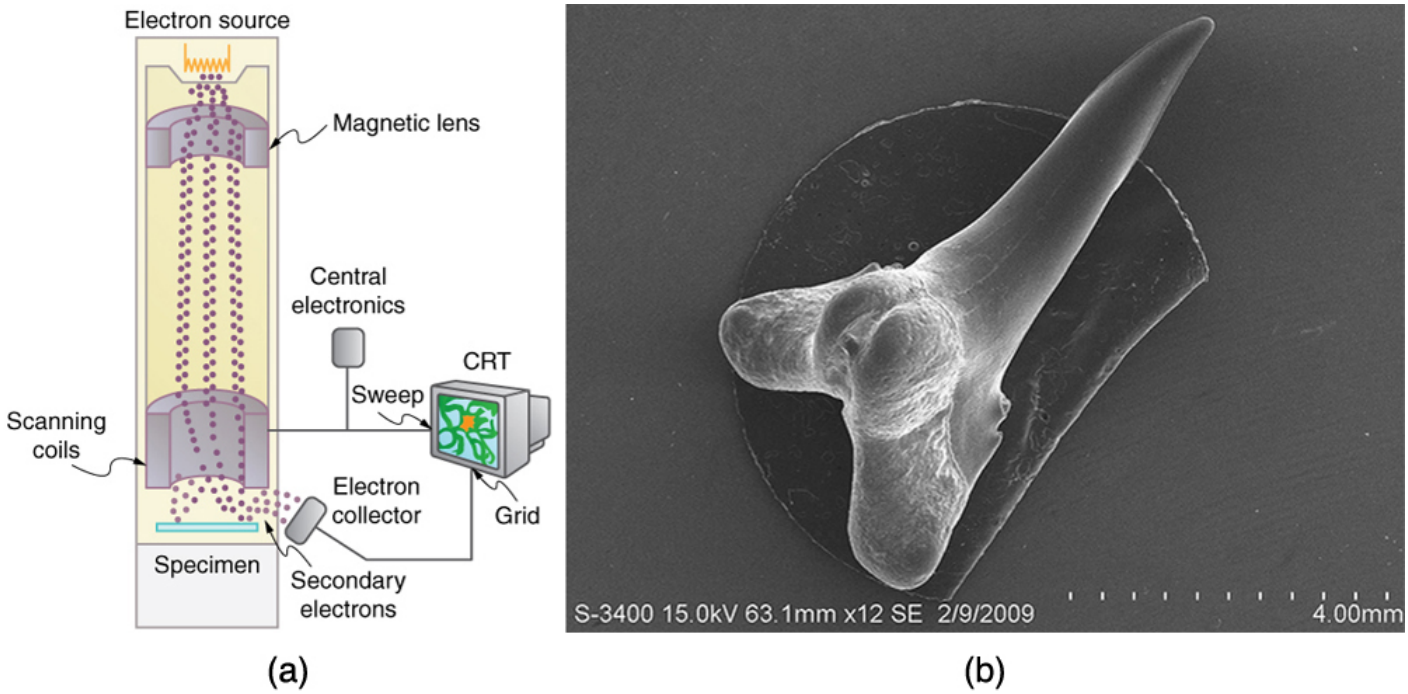

Figure 1.4: Schematic of a scanning electron microscope (SEM) (a) used to observe small details, such as those seen in this image of a tooth of a Himipristis, a type of shark (b).