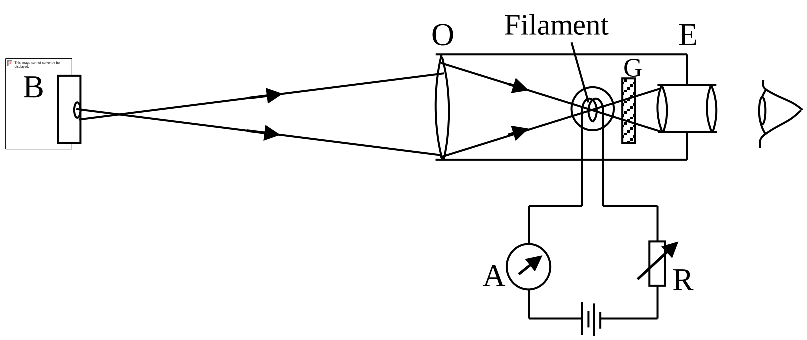
PYROMETRY

Pyrometry is the measurement of temperature by basing on the radiation that bodies emit. The instrument used to achieve this is called **a pyrometer**
Examples of pyrometers include;

The Optical Pyrometer

This responds to visible radiation (light) only. The figure below shows one known as the ***disappearing filament pyrometer.***



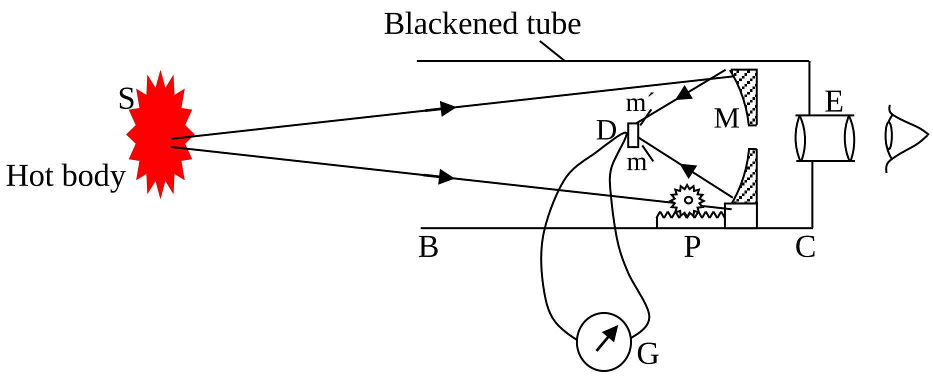
It consists of a telescope, OE, and a lamp having a tungsten filament. G is a red filter through which light from the body, B, whose temperature is required passes. The eyepiece, E, is focused upon the filament. B is then focused by the objective lens O so that its image lies in the plane of the filament. The temperature of the filament is adjusted using rheostat R until it "disappears" in the background of the radiation from B. The ammeter, A, which measures the current, is calibrated to read temperature in degrees directly of the filament in degrees. This is also the temperature of the hot body B.
The range of an optical pyrometer can be extended by introducing a filter of green glass between O and the filament, in which case a second scale on the ammeter is required for use whenever the filter is inserted.

Pyrometers are calibrated assuming black body radiation. Therefore they show lower temperatures than actual for non-black bodies, which radiate less intensely than a black body at the same temperature. A correction, depending on the spectral emissivity of the body for red light must be applied.

The Total Radiation Pyrometer

This pyrometer responds to both visible and infra red radiation.

This type can only be used when the source of radiation is large



It consists of a blackened tube, open at end B. D is a thermocouple attached to a small blackened copper disc facing end C and is shielded from direct radiation. M is a gold-plated mirror, pierced at its centre to allow radiation to reach the eyepiece, and movable by a rack and pinion P.
In use, the eyepiece, E, is first focused upon the disc D. M is then adjusted until the source, S, is also focused upon D. The radiation from the hot body falls on M and is reflected on to D to which a thermocouple junction is connected. The disc D is heated by the radiations and reaches an equilibrium temperature when it is losing heat at the same rate as it is receiving it. The thermoelectric emf causes a deflection on the galvanometer, G, which is calibrated directly to read the temperature of the source. The galvanometer G is calibrated by sighting it at molten gold (***melting point 1063^{o}c***) and If T is the temperature of the hot body and θ is the temperature of the hot body, then $\theta \propto T^4$

Thus, $\frac{\theta}{\theta_{AU}} = \frac{T^4}{T^4{}_{AU}}$ .This gives the temperature T of the hot body, where θ is the deflection of galvanometer when the instrument is focused on hot body, θ_{AU} is the deflection of the galvanometer when instrument is focused of gold, T_{AU} is the temperature of molten gold.
For easier focusing, two small plane mirrors m' and m are fitted in front of D. They are inclined with their normals at about 5^o to the axis of the tube, and have semicircular holes to allow radiation from M to reach the disc. When out of focus the mirrors appear as shown in figure (i). When in correct focus, they appear as in figure (ii) below

(i) (ii)