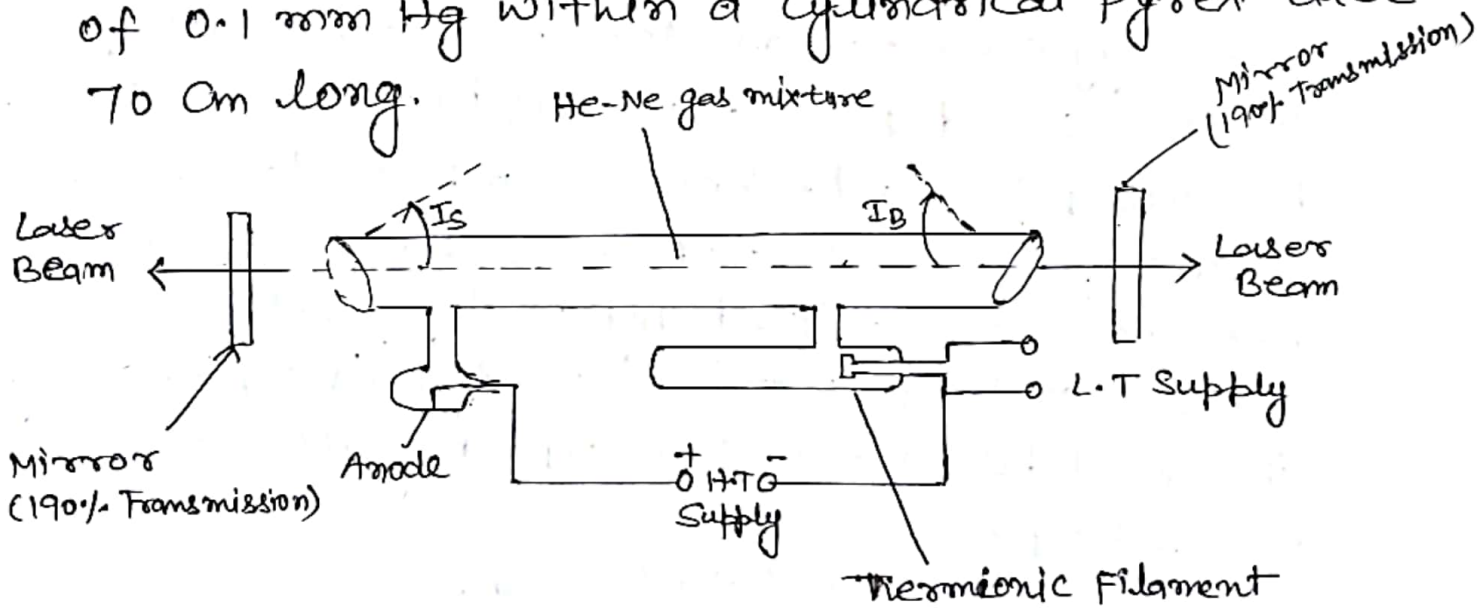


Construction and Working of a He-Ne Laser.

The Neon-gas is an active agent. The Helium is necessary for energy transfer. The direct current through the gas creates the necessary electrons in the gas discharge. These electrons excite the helium atom to the meta-stable 2^1S and 2^3S levels.

The process includes a mixture of helium at a pressure of 1 mm Hg and neon at a pressure of 0.1 mm Hg within a cylindrical pyrex tube 70 cm long.



It is fitted with optically polished glass plates and set at the Brewster angle. Outside the Brewster window are the Fabry-perot plane parallel mirrors of silica, each coated with multiple dielectric layers to give a reflection coefficient of 98%.

It is convenient for end windows to be set at the Brewster angle to the tube because they

enable one linearly polarised component of the light to undergo very small reflection loss.

The Fabry-perot mirrors can then be outside the tube with little loss of this polarised light in the Brewster window. These mirrors can be set in mounts for ready adjustment in turning the gas laser to optimum output. The laser beam emerges at both ends. The tube has a coated filament source of electrons at one end and anode at the other end. ~~The tube has~~ It requires powers of the order of 50 mW and the operation is continuous.

Action:— The collisions of the excited helium atoms with the neon atoms result in a transfer of energy to the neon atoms. The close multiple levels 3s and 2s of electrons in the neon thereby become populated. These 3s and 2s electrons levels of neon are metastable. The lower 2p levels of neon are short-lived and so depopulate very rapidly to 1s levels. Population inversion is consequently obtained between 2s and 2p, and also between 2s and 2p.

The stimulated emission responsible for the laser light is consequently $3s \rightarrow 2p$ and $2s \rightarrow 2p$. Since the 3s and the 2s levels are both quadruplets, while the 2p consists of 10 close levels.

This gives rise to a corresponding multiplicity of laser lines. Isolation of particular lines in the gas laser output is therefore a problem of mode control depend upon the Fabry-perot arrangement of the mirrors. The wavelengths at which the He-Ne gas laser are 6328 Å to 11,523 Å