Microwave Engineering

Unit-3

REENTRANT CAVITY

- Therefore the reentrant cavities are designed for use in klystron and microwave triodes
- A reentrant cavity is one in which the **metallic boundaries extend into the interior** of the cavity

- Inductance decreased
- Reduced resistance losses

- Prevents radiation losses

Mechanism of Oscillation

- It is assumed that the **oscillations are set up in the tube initially** due to noise or switching transients and the oscillations are sustained by device operation.
- The **electrons** passing through the cavity gap d **experience this RF field** and are **velocity modulated.**

Applegate diagram

- The electrons B which encountered the positive half cycle of the RF field in the cavity gap d will be accelerated, A which encountered zero RF field will pass with unchanged original velocity, and c which encountered the negative half cycle will be retarded on entering the repeller space.
- All these velocity modulated electrons will be repelled back to the cavity by the repeller due to the negative potential.

- The repeller distance L and the voltages can be adjusted to receive all the electrons at a same time on the positive peak of the cavity RF velocity cycle.
- Thus the velocity modulated electrons are bunched together and **lose their kinetic energy when they encounter the positive cycle of the cavity RF field.**

- Bunches occur once per cycle centered around the reference electron and these **bunches transfer maximum energy to the gap** to get sustained oscillations.
- For oscillations to be sustained, the time taken by the electrons to travel into the repeller space and back to the gap (**transit time**) must have an **optimum value.**

Mode of Oscillation

- The electrons should return after 1¾, 2 ¾ or 3 ¾ cycles – most optimum departure time.
- If **T is the time period at the resonant frequency**, t_o is the time taken by the reference electron to travel in the repeller space between entering the repeller space and returning to the cavity at positive peak voltage on formation of the bunch

Then, $t_o = (n + ¾)T = NT$

Where $N = n + ¾$, $n = 0,1,2,3…….$

N – mode of oscillation.

- The mode of oscillation is named as N = ¾, 1 ¾ 2 ¾ etc for modes n = 0,1,2……resp.

The Power output of lowest mode?