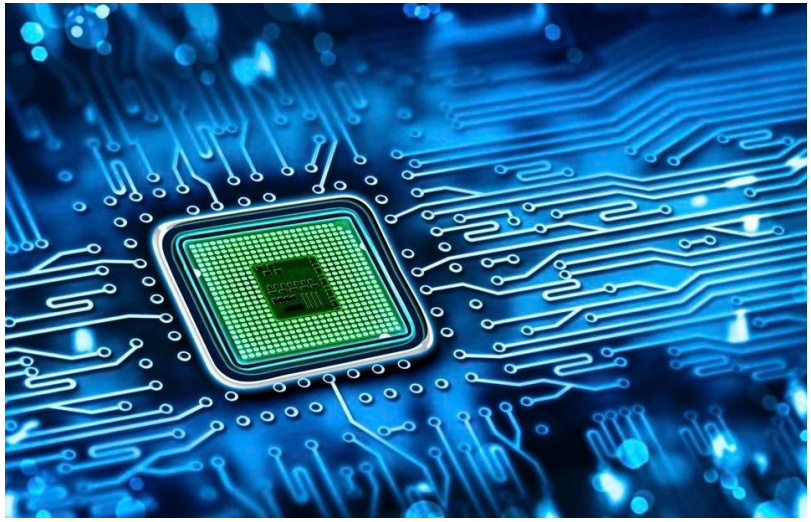
Two Cavity Reflex Klystron



Two Cavity Reflex Klystron

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- Introduction of Two Cavity Klystron
- Construction of Two Cavity Klystron
- Two Cavity Klystron Amplifier
- Performance Characteristics
- Application

Two Cavity Reflex Klystron

Introduction

- A Klystron is a vacuum tube that can be used either as a generator or as an amplifier or as an oscillator, at microwave frequencies.
- The Klystron is a linear beam device; that is, the electron flow is in a straight line focused by an axial magnetic field.
- The velocities of electrons emitted from the cathode are modulated to produce a density-modulated electron beam.

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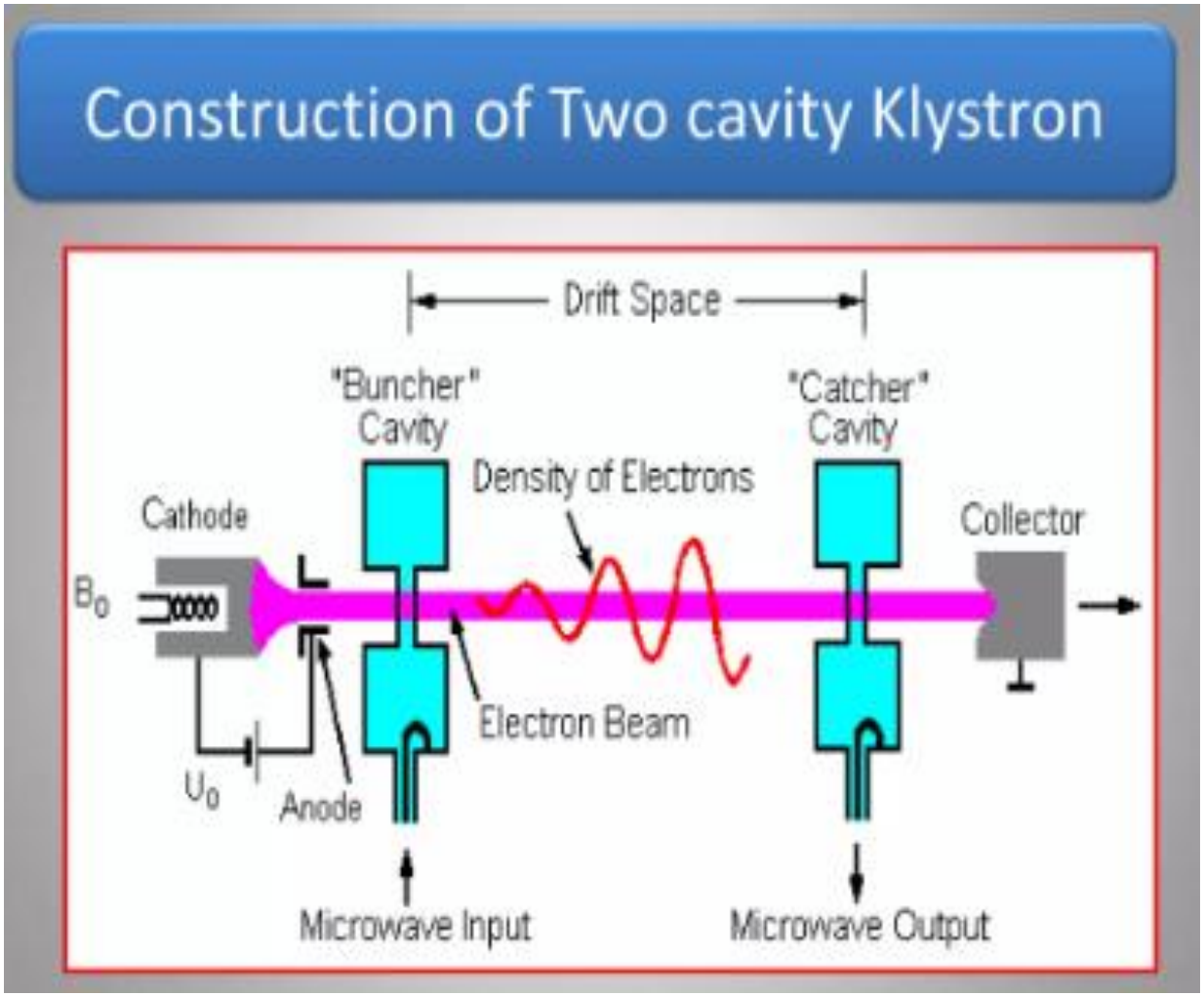

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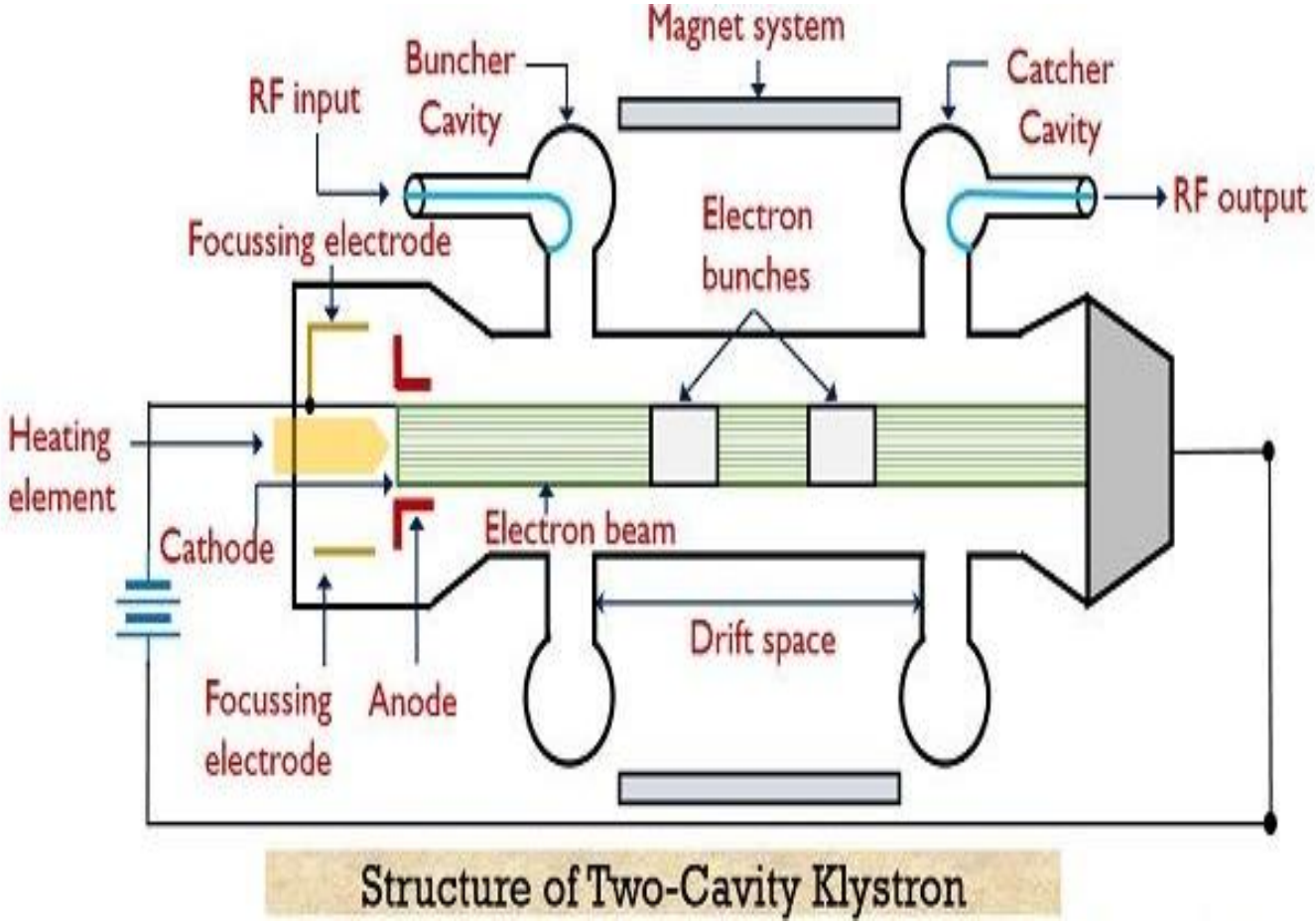


Structure of Two-Cavity Klystron

Two Cavity Reflex Klystron

Working

- The first grid next to the cathode controls the number of electrons in the electron beam and focuses the beam.
- The voltage accelerates the DC electron beam to a high velocity before injecting it into the grids of the buncher cavity.
- The grids of the cavity enable the electrons to pass through, but they confine the magnetic fields within the cavity
- Electrons traversing the interaction space when the RF potential on grid 3 is positive with respect to grid 2 are accelerated by the field.
- The decelerated electrons give up energy to the fields inside the buncher cavity, while those that have been accelerated absorb energy from its fields.

Two Cavity Reflex Klystron

Performance Characteristics

- Frequency : 250 MHz to 100 GHz (60 GHz nominal).
- Power : 10 kW – 500 kW (CW) 30 MW (pulsed).
- Power Gain : 15 dB – 70 dB (60 dB nominal).
- Bandwidth : Limited 10 – 60 MHz Generally used in fixed Freq. application.
- Noise Figure : 15 – 20 dB
- Theoretical Efficiency : 58 % (30 – 40 % nominal).

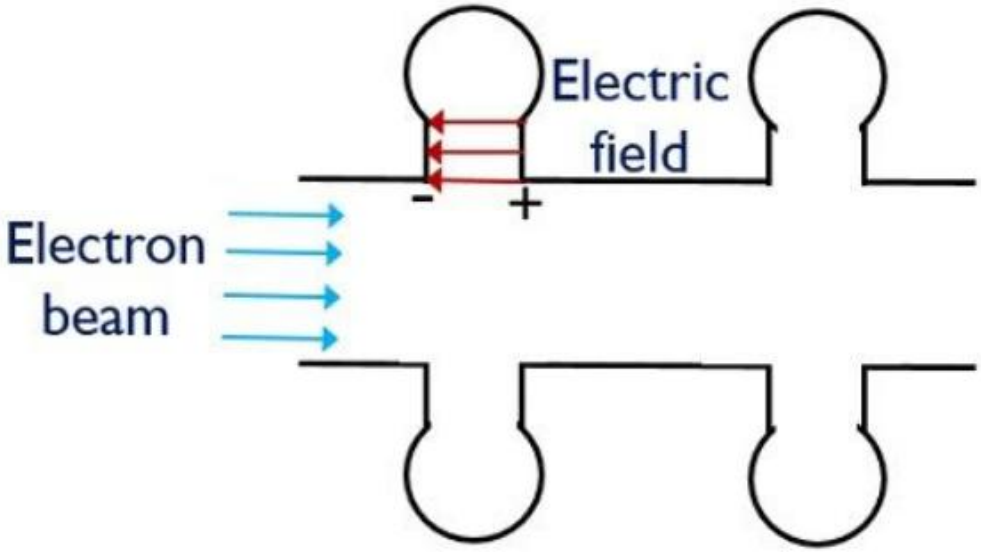
Two Cavity Reflex Klystron

Application

- **As power output tubes**
  1. in UHF TV transmitters
  2. in troposphere scatter transmitters
  3. Satellite communication ground station
  4. Radar transmitters
- **As power oscillator** (5 – 50 GHz), if used as a klystron oscillator

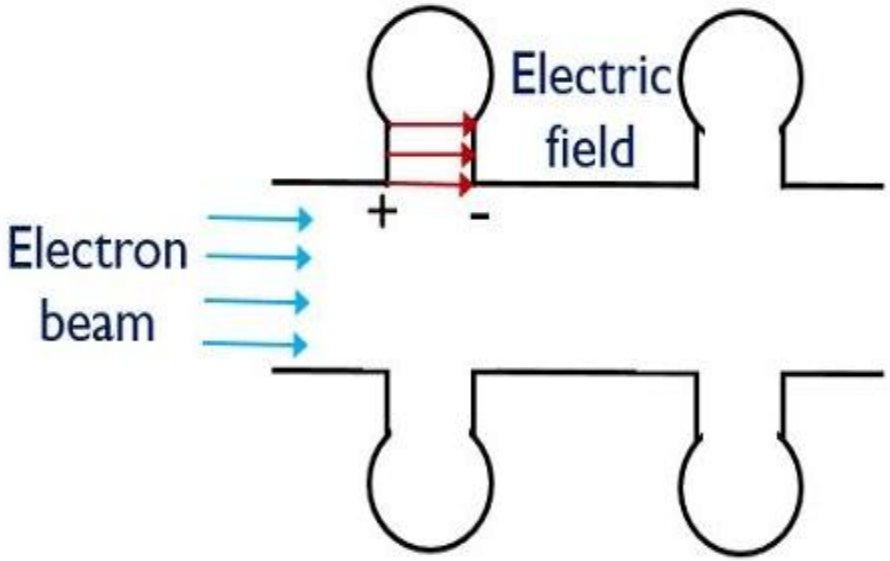
Two Cavity Reflex Klystron

1. When the negative half of the RF signal is provided as input to the buncher cavity then the moving electrons experience a repulsive force due to the presence of a negative charge at the entering plate of the buncher cavity.



Two Cavity Reflex Klystron

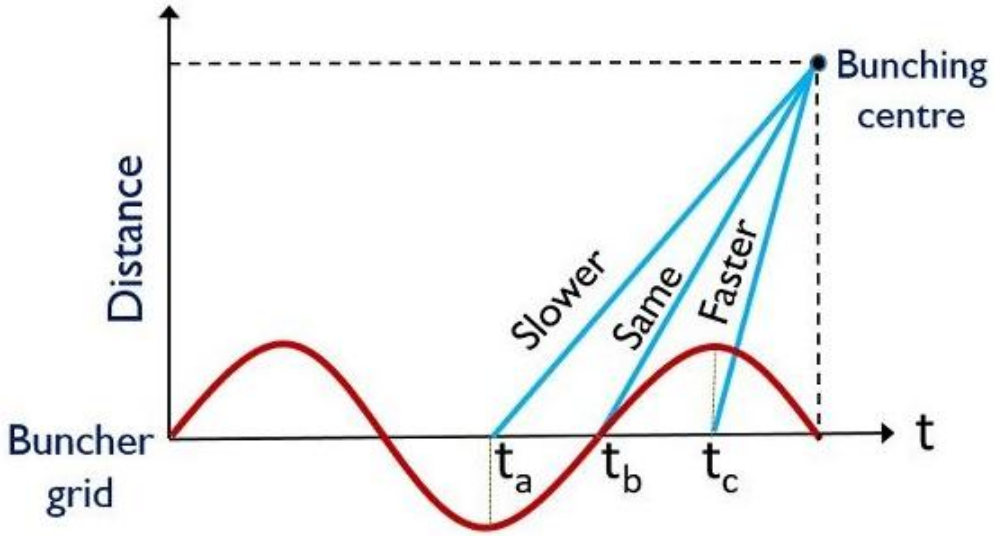
2. Further when the positive half of the RF signal is provided then the positive potential at the first plate of the cavity applies attractive force to the moving electrons. More simply, for the positive half cycle of input, the generated electric field will be in a direction similar to the direction of electron movement.



Two Cavity Reflex Klystron

Applegate Diagram

The figure below shows the Applegate diagram that represents the bunching of electrons moving with different velocities:



Bunching process

Applications

The two-cavity Klystron finds application in satellite communication, UHF TV transmitters as well as radar systems, wideband high power communication and troposphere scatter transmitters etc.


Thank
you