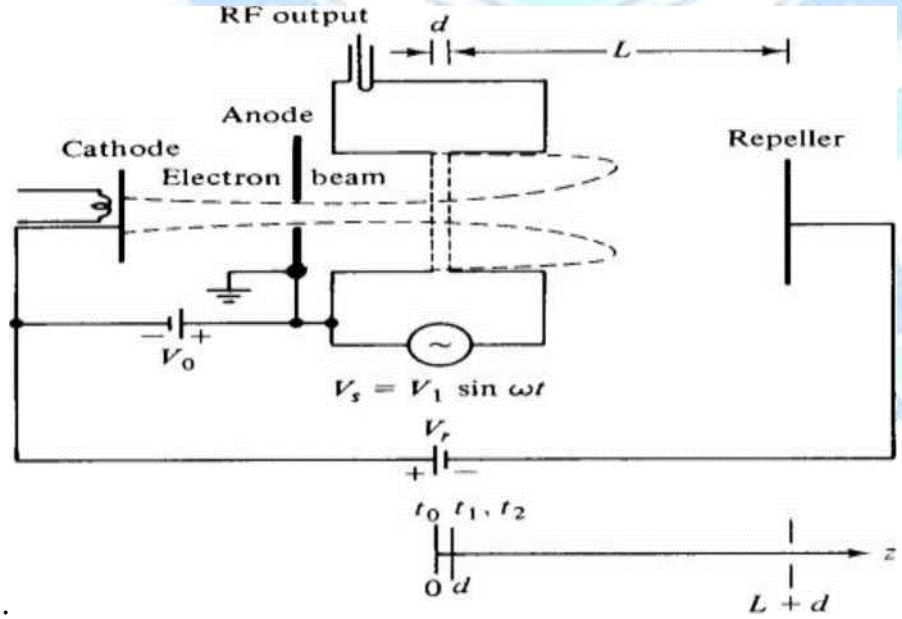
3.2.1 Reflex Klystron or Repeller Klystron

Another tube based on velocity modulation, and used to generate microwave energy, is the reflex klystron (repeller klystron). The reflex klystron contains a reflector plate, referred to as the repeller, instead of the output cavity used in other types of klystrons. The electron beam is modulated as it was in the other types of klystrons by passing it through an oscillating resonant cavity, but here the similarity ends.

The feedback required to maintain oscillations within the cavity is obtained by reversing the beam and sending it back through the cavity. The electrons in the beam are velocity-modulated before the beam passes through the cavity the second time and will give up the energy required to maintain oscillations. The electron beam is turned around by a negatively charged electrode that repels the beam ("repeller"). This type of klystron oscillator is called a reflex klystron because of the reflex action of the electron beam



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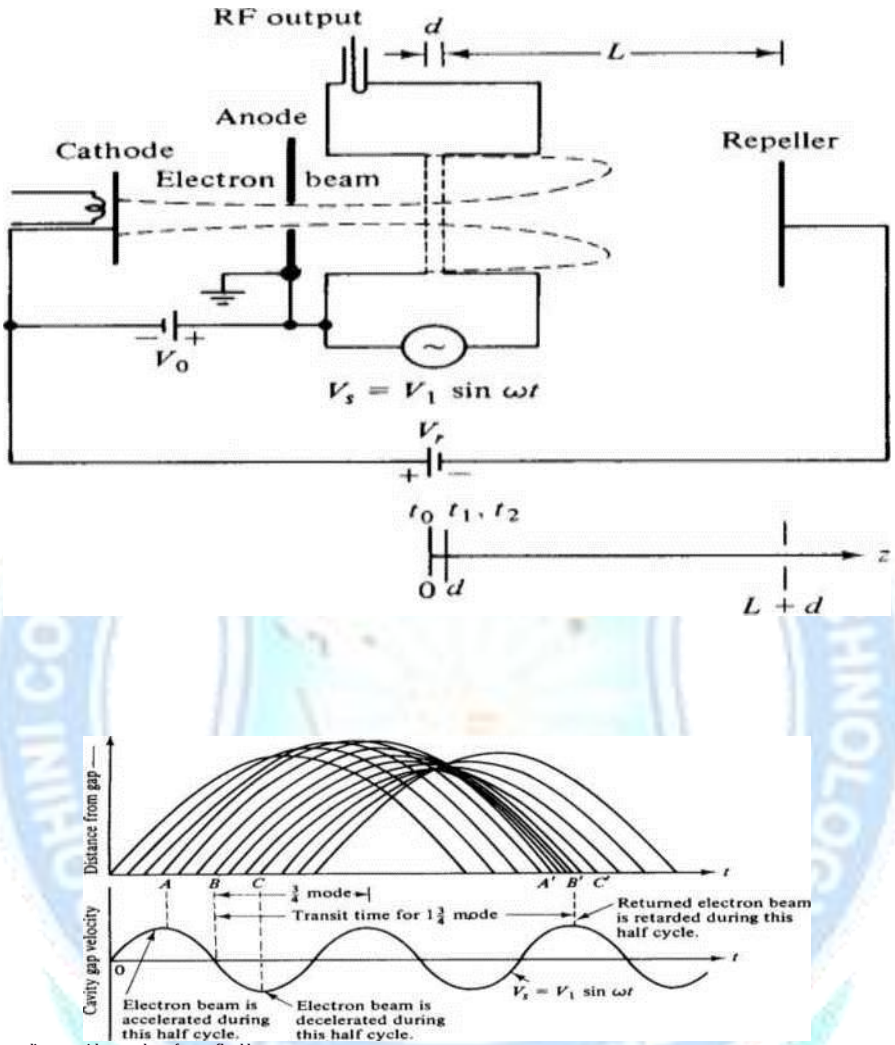
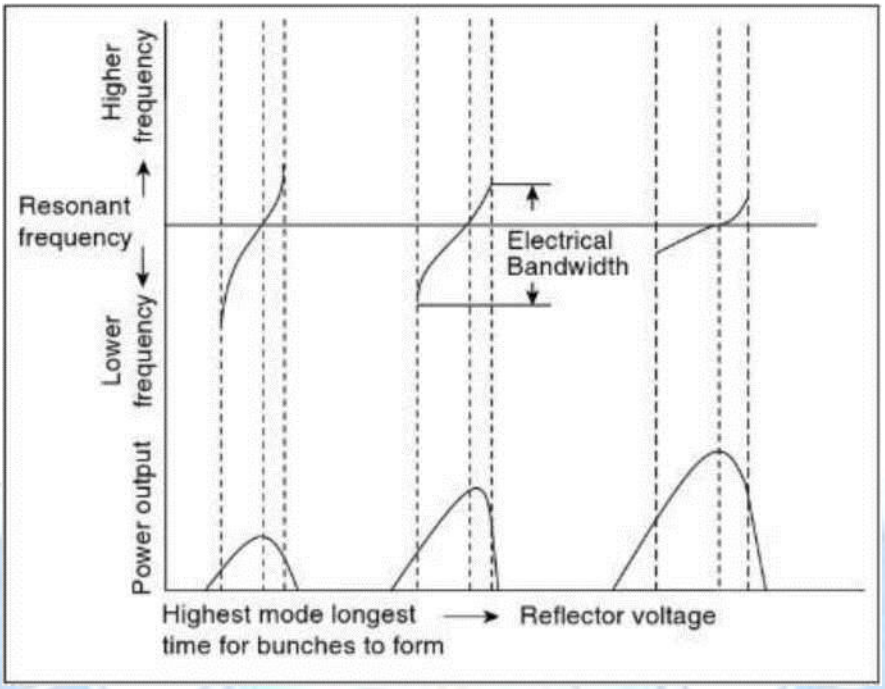


Figure 9-4-2 Applegate diagram with gap voltage for a reflex klystron.

Figure 3.5: Schematic of Reflex Klystron and applegate diagram

Repeller klystrons are often used in older radar sets as local oscillators or as oscillators in measurement sets. If the voltage feed is keyed, then the repeller klystron can be used for RF-pulse generation too, but as self-oscillating tube it provides a non-coherent oscillation only.

Modes and o/p characteristics



The output frequency and the output power vary with the change in repeller voltage for different modes are shown in below figure. These modes are called mode curves.

Figure 3. 6: Different Modes Curves

The oscillation frequency is determined by the frequency of resonance of the output cavity,This is called as electronics tuning range of reflex klystron **o/p characteristics:**

The adjustment of repeller and anode voltage is in such a way that the bunch appears exactly at any of the +ve maximum voltage of the RF signal, which is necessary for reflex klystron to undergo oscilation.The oscillations cab be achieved only for some combination of anode and repeller voltages. The voltage or output characteristics of reflex klystron are shown in the below figure 3.7

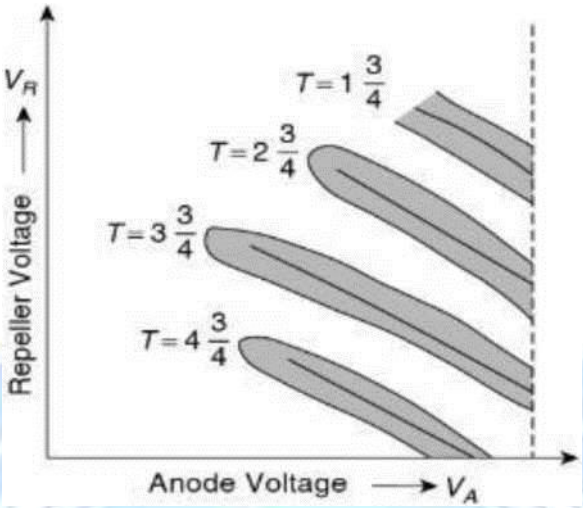


Figure 3.7 o/p characteristics

Electronic Tuning :

The nature of the variation of output power and frequency by adjustment of the repeller voltage is calld the electronic tuning.It can be measured by electronic tuning sensitivity(ETS).This can be determined by considering the slpe of the frequency of the modes.

We know the equations

$$(V_r + V_0)^2 = \frac{8mL_r^2 V_0}{\left(2\pi n - \frac{\pi}{2}\right)^2 . e} . \omega^2$$