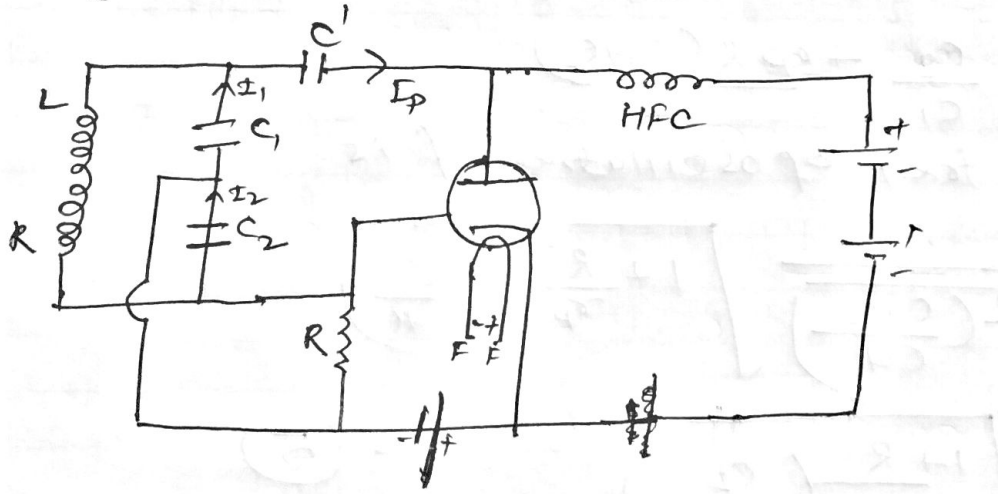
COLPITTS OSCILLATOR :-

In this oscillator, the cathode is connected to the tapping point of the capacitor instead of the coil. A grid leak resistor R_g is used to provide a conducting path between the grid and the cathode. As the circuit is shunt-fed a high-frequency choke (HFC) is also essential here.

In addition a low-reactance capacitor C' is utilized to prevent direct ~~voltage~~ anode voltage from the grid. If we neglect these extra components, the simplified equivalent circuit will be similar to that as shown in fig.



In this case,

$$V_{eg} = I_p r_p + \frac{I_1}{j\omega C_1} \quad \text{---(1)}$$

$$\text{and } e_g = \frac{I_2}{j\omega C_2} \quad \text{---(2)}$$

$$\& \quad I_p = I_1 - I_2 \quad \text{---(3)}$$

$$\text{and } \frac{I_1}{j\omega C_1} + I_2\left(R + j\omega L + \frac{1}{j\omega C_2}\right) = 0 \quad \text{---(4)}$$

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Solving these equations for voltages and currents, the oscillatory condition and the frequency of oscillation of the circuit.

The condition for the circuit to be oscillatory may be expressed as,

$$1+\mu = \left[\frac{C_1+C_2}{C_1} + \frac{r_p R (C_1+C_2)}{L}\right]\left[1+\frac{RC_2}{r_p(C_1+C_2)}\right]$$

$\therefore$ If $RC_2 \ll r_p(C_1+C_2)$ we have

$$1+\mu = \frac{C_1+C_2}{C_1} + \frac{r_p R (C_1+C_2)}{L}$$

$$\text{or, } \mu = \frac{C_2}{C_1} + \frac{r_p R (C_1+C_2)}{L}$$

Again, the freq. of oscillation f is

$$f = \frac{1}{2\pi\sqrt{L\left(\frac{C_1C_2}{C_1+C_2}\right)}}\sqrt{1+\frac{R}{r_p}\left(\frac{C_2}{C_1+C_2}\right)}$$

$$= f_R\sqrt{1+\frac{R}{r_p}\left(\frac{C_2}{C_1+C_2}\right)} \quad \text{---------- (5)}$$

Where f_R is the resonant frequency of the tuned circuit. eqn (5) shows that the frequency of oscillation can easily be altered by varying f_R which is tuned may be changed by changing the value of the inductance L.

Teacher's Signature

series-fed is not possible in Colpitts oscillator, since with series-fed no d-c path is available from Plate to Cathode.

It is interesting to note here that the frequency of oscillation in Colpitts oscillator is greater than the resonant frequency while in Hartley oscillator it is less than the resonant frequency of the tuned circuit.