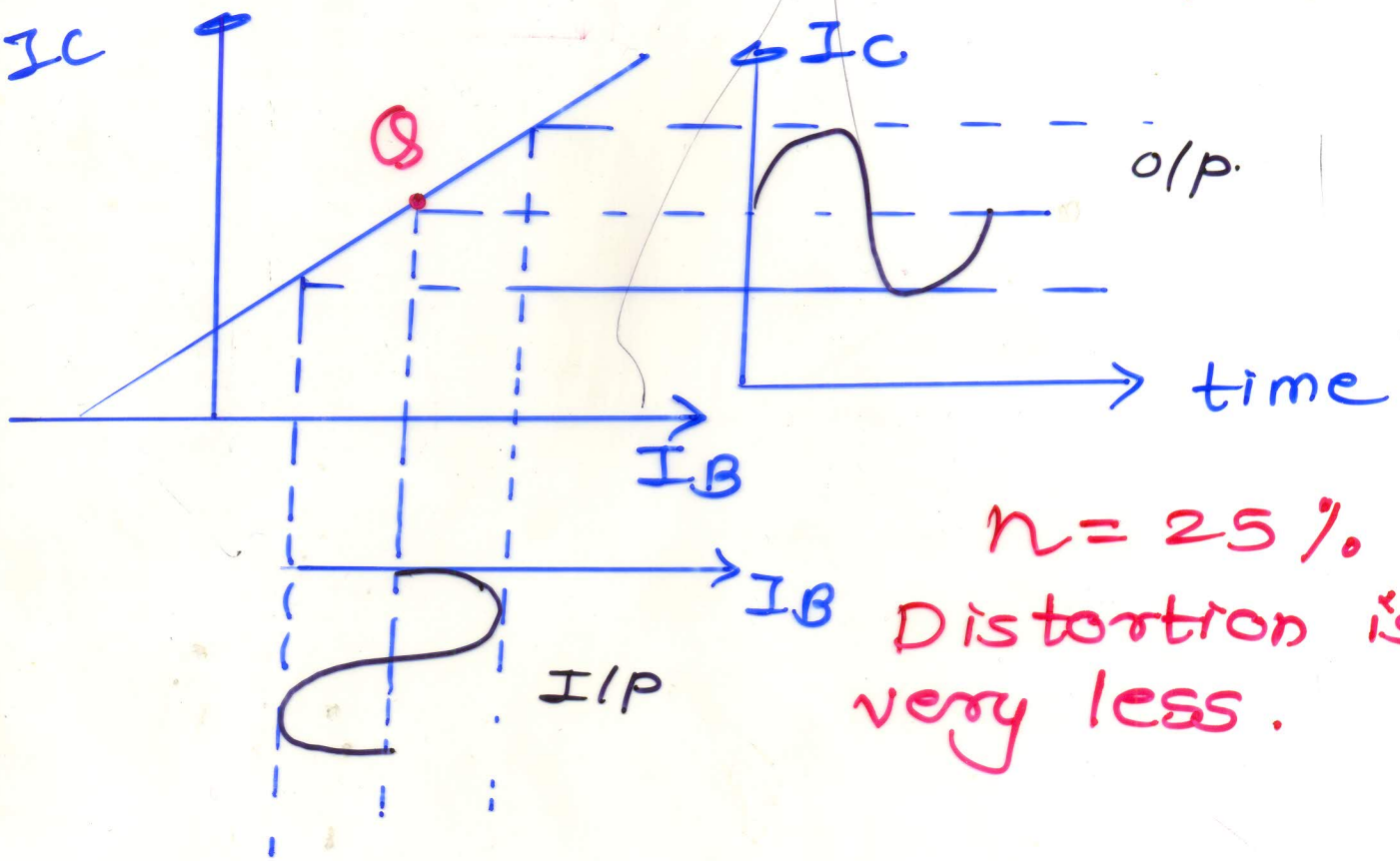
Class A Power Amplifier -

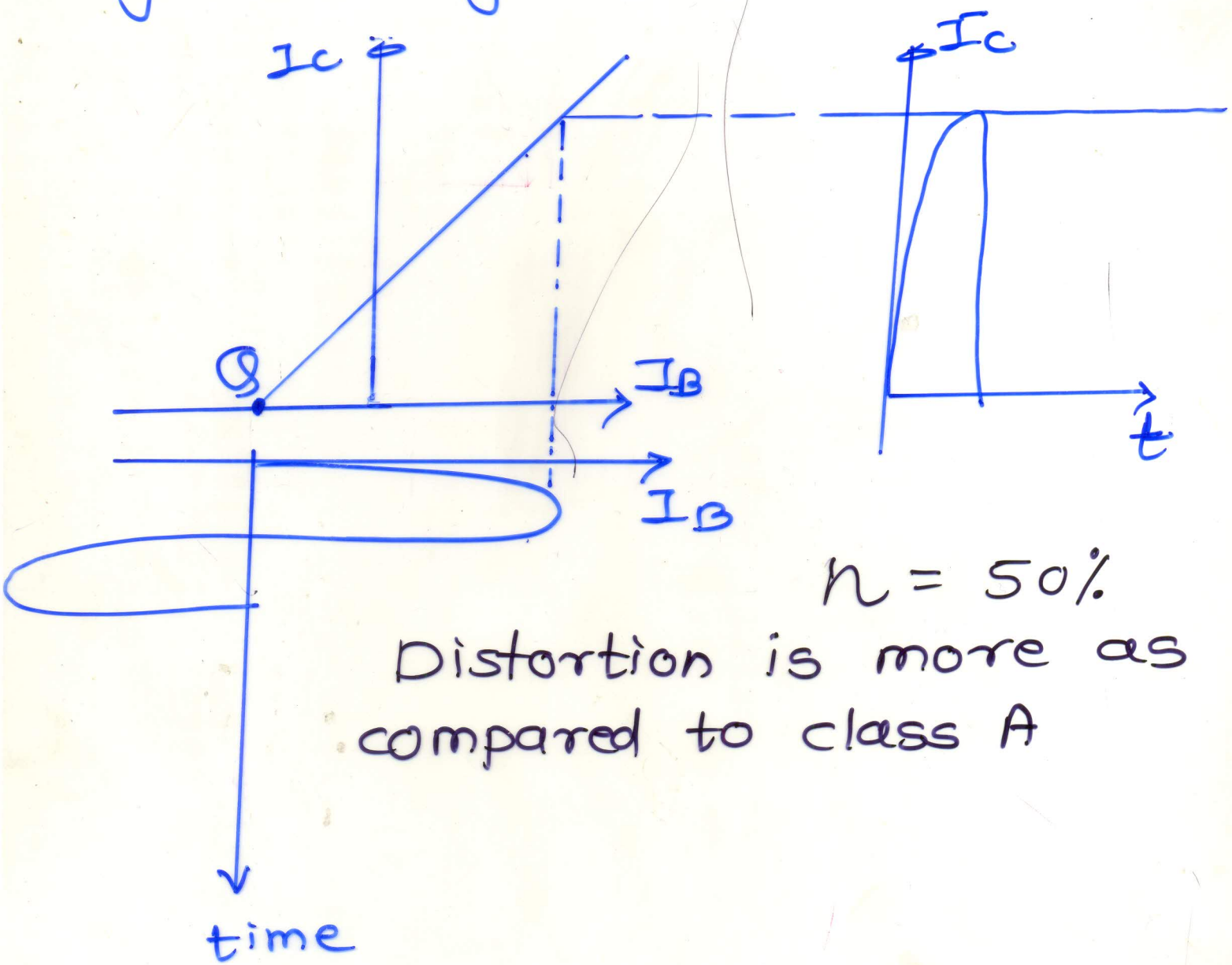
Here operating point is selected in the linear part of the transfer characteristics and I/P signal is applied in such a way that o/p current or collector current flows for complete I/P cycle (360°)



$\eta = 25\%$

Distortion is very less.

Class B Power Amplifier — Here operating point is selected at cut-off and signal is applied in such a way that o/p current flows for only half cycle ie for 180°.

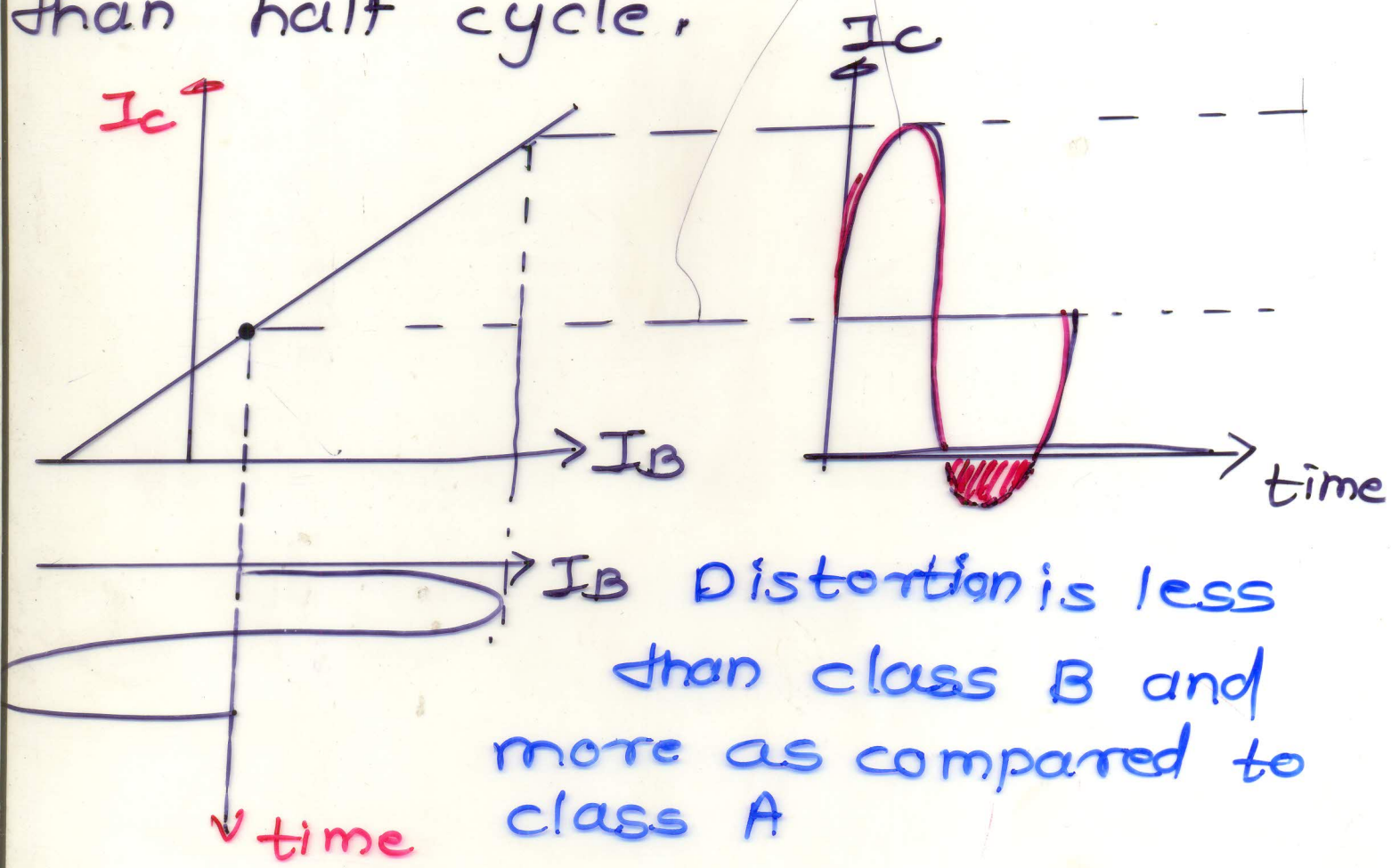


$\eta = 50\%$

Distortion is more as compared to class A

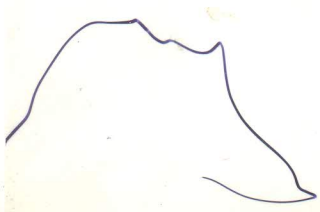
CLASS AB Power Amplifier.

Here operating point is selected just below the operating point of class A amp^{r}. and I/p signal is applied in such a way that o/p current or collector current flows for less than full cycle and more than half cycle.



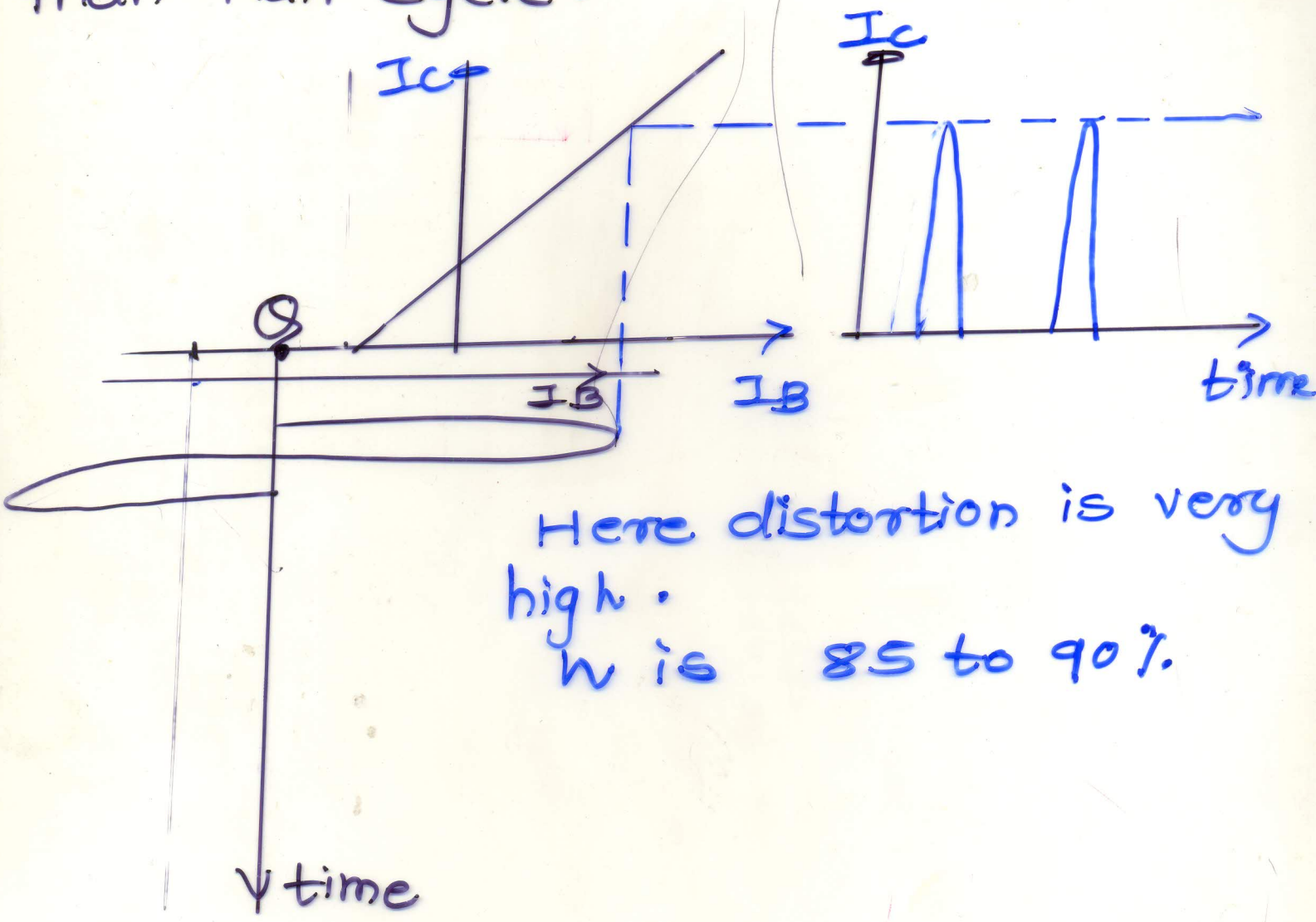
Distortion is less than class B and more as compared to class A

Parameter	Voltage Amp^r	Power Amp^r
β	high > 100	Low (20 to 50)
R_c	high (4-10) kΩ	Low (5 to 20) Ω
Coupling	R-C	Transformer
Input Voltage	Low few mV	high (2-4 V)
collector Current	low ≅ 1mA	high (> 100mA)
power o/p	low mw	high watts.
O/P Impedance	high (12kΩ)	low (200Ω)
	BC 147	2N3055
Doping concentration	less	high
Base	Thin	Thick
Size	Small	large.



CLASS C Power Amplifier ④

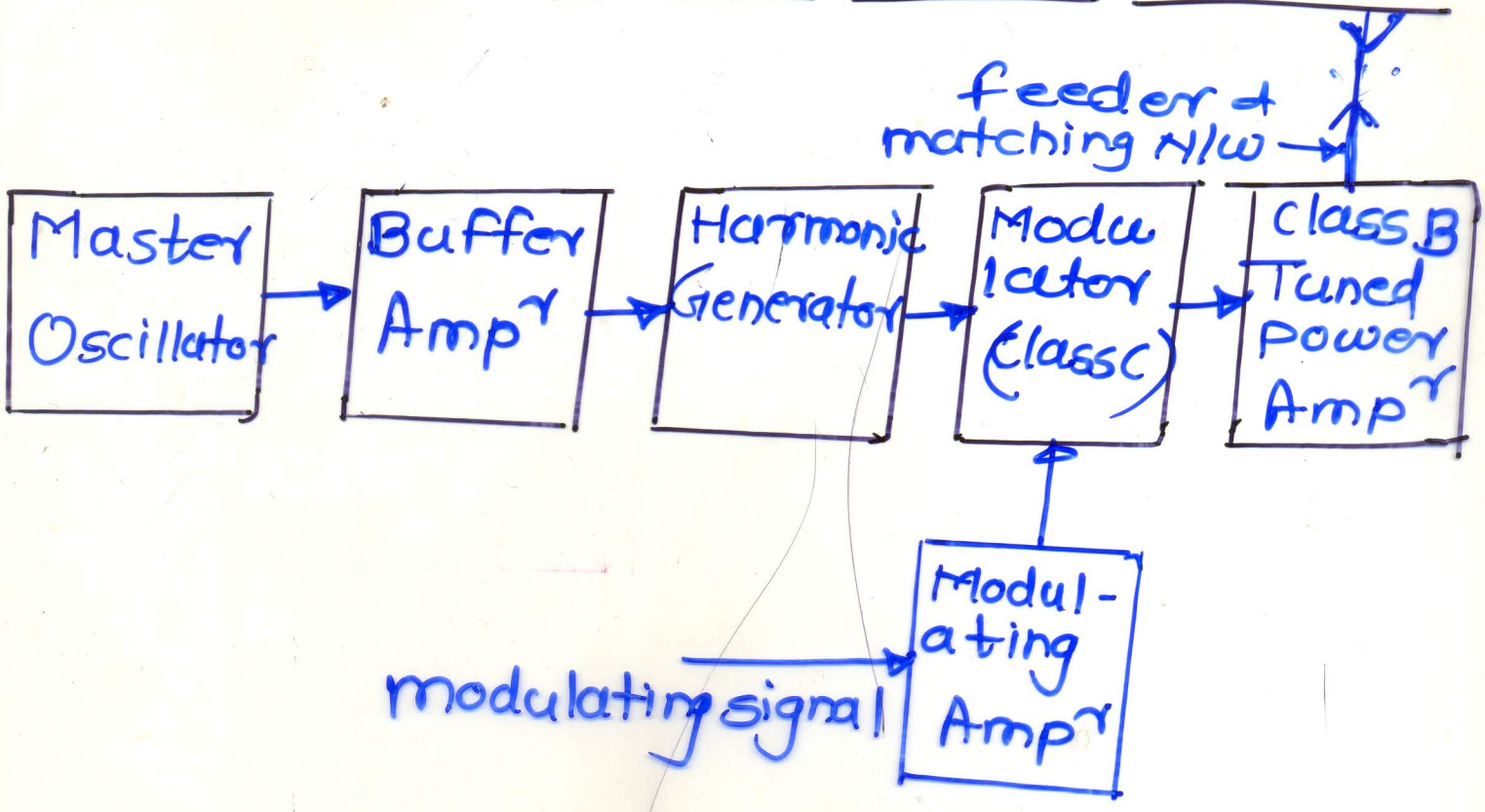
Here operating point is selected beyond the cut-off point and I/P signal is applied in such a way that o/p current or collector current flows for less than half cycle.



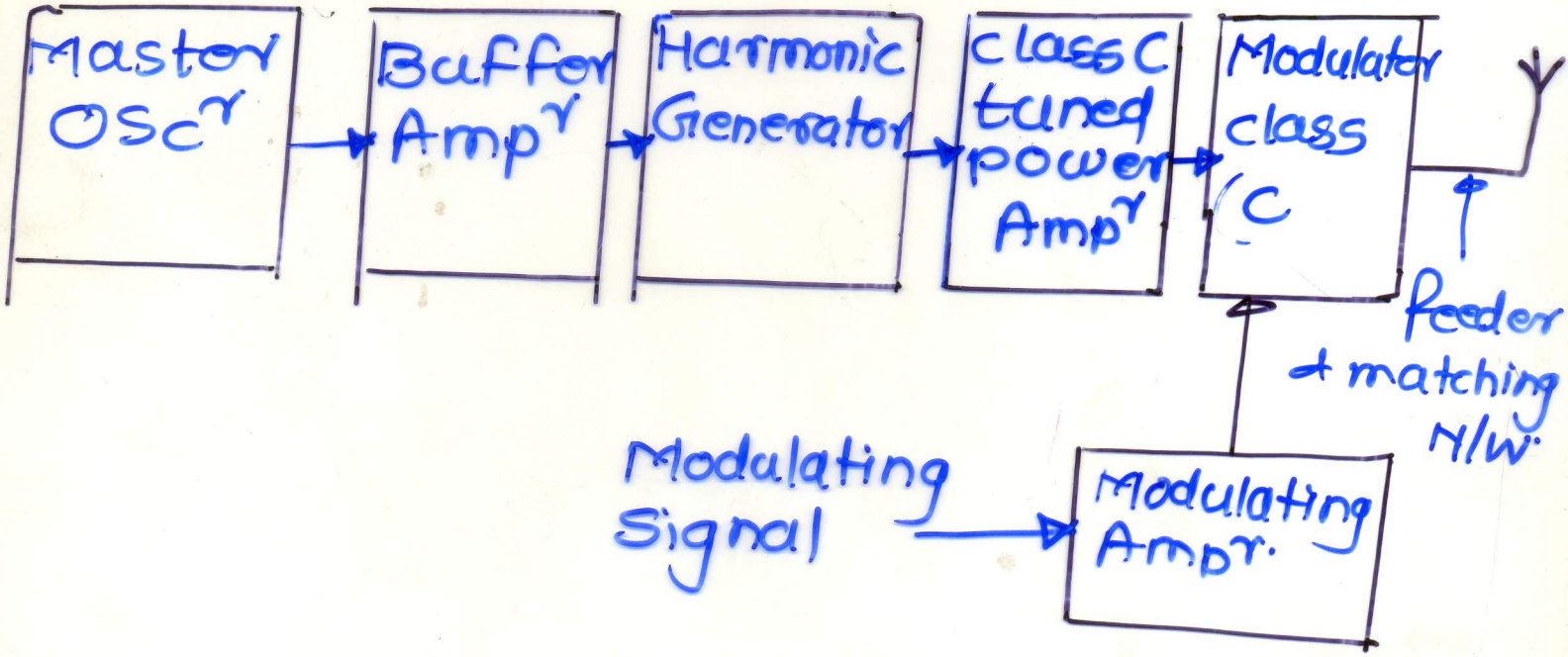
Here distortion is very high.

η is 85 to 90%.

AM Tx^r Using Low Level Modulation



AM Tx^r Using High Level Modulation



Low Level AM Tx^r

- Modulation takes place at low power level and then signal is power amplified by class B RF power amp^r
- Lower power efficiency of class B RF amp^r as compared to class C
- Can not use class C power Amp^r as i) it does not faithfully reproduce the modulated signal consisting of carrier & both sidebands.

  ii) class C amp^r having narrow Bandwidth which may cause sideband cuttings, that results in distortion.

High Level Modulation

Power level of the carrier is increased to desired extent before modulation is achieved. This is done in high level modulation.

Here carrier is first amplified by class C amp^r, then modulation is done at high power level

other Block's Description

1) Master Osc^r –

- Generates a stable sub-harmonics of carrier freq.
- stable crystal Osc^r are easy to make at lower carrier frequencies
- stability of M.O frequency is important because any change in M.O frequency will cause interference with other the other transmitting stations.
- Freq of M.O changes due to
1) time (aging) 2) temperature
3) loading effect.

Hence precautions are taken for stability of M.O

1) constant temperature chamber
2) stabilized power supply
3) Buffer amp^r b/w M.O & harmonic Generator.

(2) Buffer Amplifier –

- provides isolation b/n M.O & rest of the cct. to avoid loading effect
- have high I/P impedance & low o/p Impedance.

(3) Harmonic Generator –

It generates harmonics of I/P freq. It multiplies the subharmonic freq generated by MO so as to get the desired transmitting frequency.

(4) Driver Amplifier

One or more stages of a class C tuned amp^r is used to increase the power level of carrier to provide large drive to the modulater class C amp^r.

Modulating Amplifier

Audio signal from microphone are amplified by a chain of audio amp^r and power amp^r.

Generally transformer coupled class B pushpull amp^r is used (N → 75 to 78i)

Modulator –

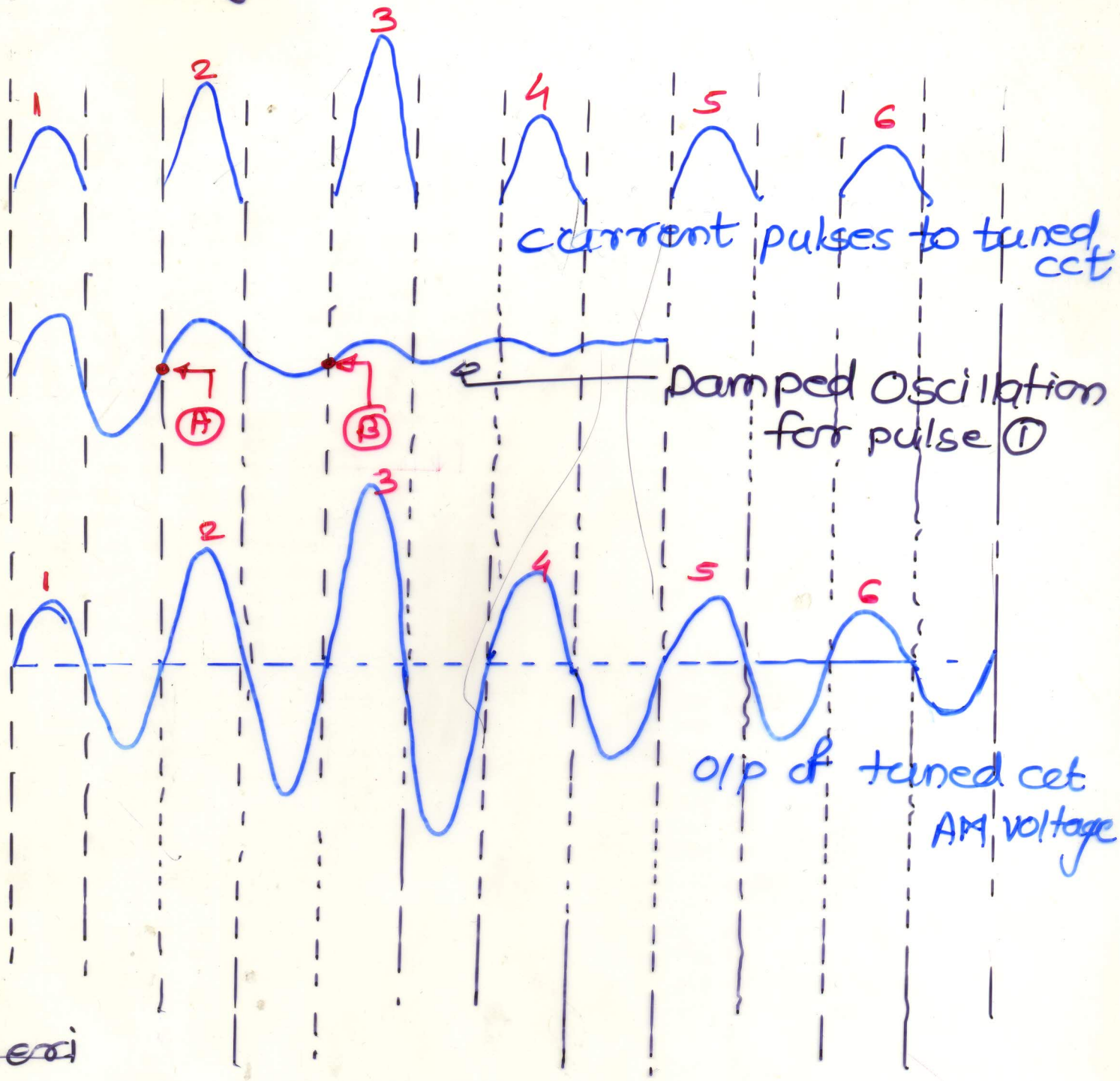
Here amplitude of carrier signal is changed in accordance with the modulating signal.

Feeder and Antenna

The antenna is normally located at a distance from transmitter. Hence power from transmitter is fed to antenna through a properly designed transmission line called feeder.

Impedance of feeder line with transmitter at one end and antenna impedance at other end must be properly matched for max^m power transfer

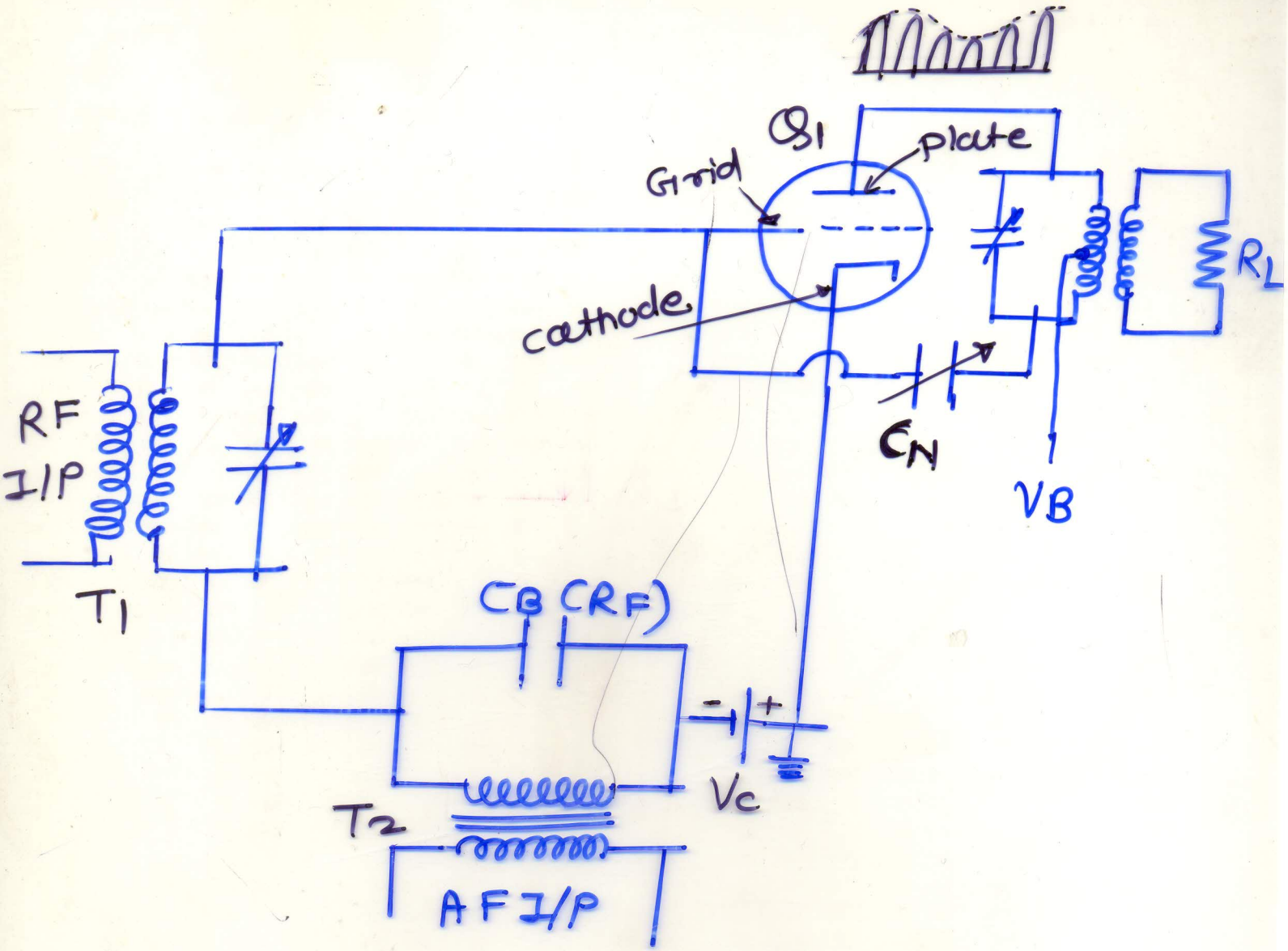
Flywheel Effect



Seeni

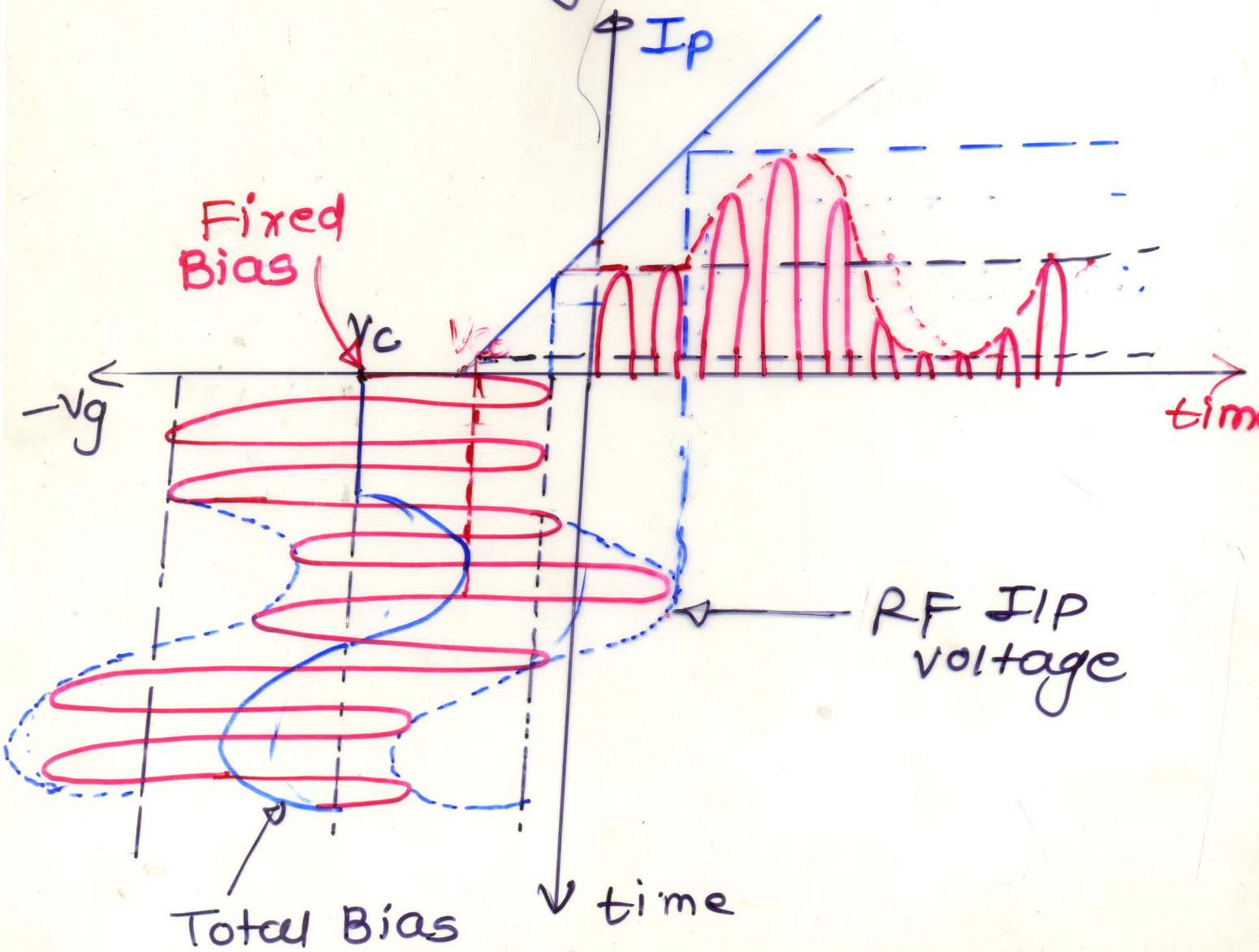
- Series of current pulses are applied to tank (tuned) cct.
- Each pulse will cause a complete sine wave proportional to the size of pulse, then amplitude goes on decaying. We get damped oscillation. Decay rate depends on time constant of the cct.
- To get AM, 2nd current pulse is applied at point @, it generates sineware corresponding to second current pulse.
- Third current pulse is applied at point ⓑ, Fourth pulse is applied at ⓒ ... so on.
  The current pulses are applied at rapid rate to nullify damping effect. This effect is called flywheel effect.

Grid Modulated Class C Amplifier (12)



- Audio signal is applied ~~through~~ T_2 Audio signal is applied in series with fixed negative bias $-V_c$, so the amplitude of the total bias is proportional to amplitude of modulating signal & varies at a rate equal to modulating signal

- Carrier is applied through T_1 across the grid and cathode of vaccum Tube. This signal is superimposed on total bias.
- Q_1 is in class C mode, resulting plate current flows in the form of pulses. proportional to modulating signal.
- These pulses are applied to tuned cct, we will get amplitude Modulation



capacitor C_N is used as a neutralizing capacitor to neutralize the effect of interelectrode capacitor.

At higher frequencies the inter-electrode capacitance enhances positive feedback hence device may start as an oscillator.

C_N provides negative feedback positive & negative feedback cancel with each other & gives stability.

Drawbacks:

(1) The modulator will operate without distortion only if the transfer cht of the triode is perfectly linear.

(2) Because of Bias conditions the maximum o/p from grid modulated amp^r is much less than obtainable from the same tube if it is unmodulated. So η is less.

(3) Harmonics are generated due to nonlinear transfer characteristics.

④ Low power output

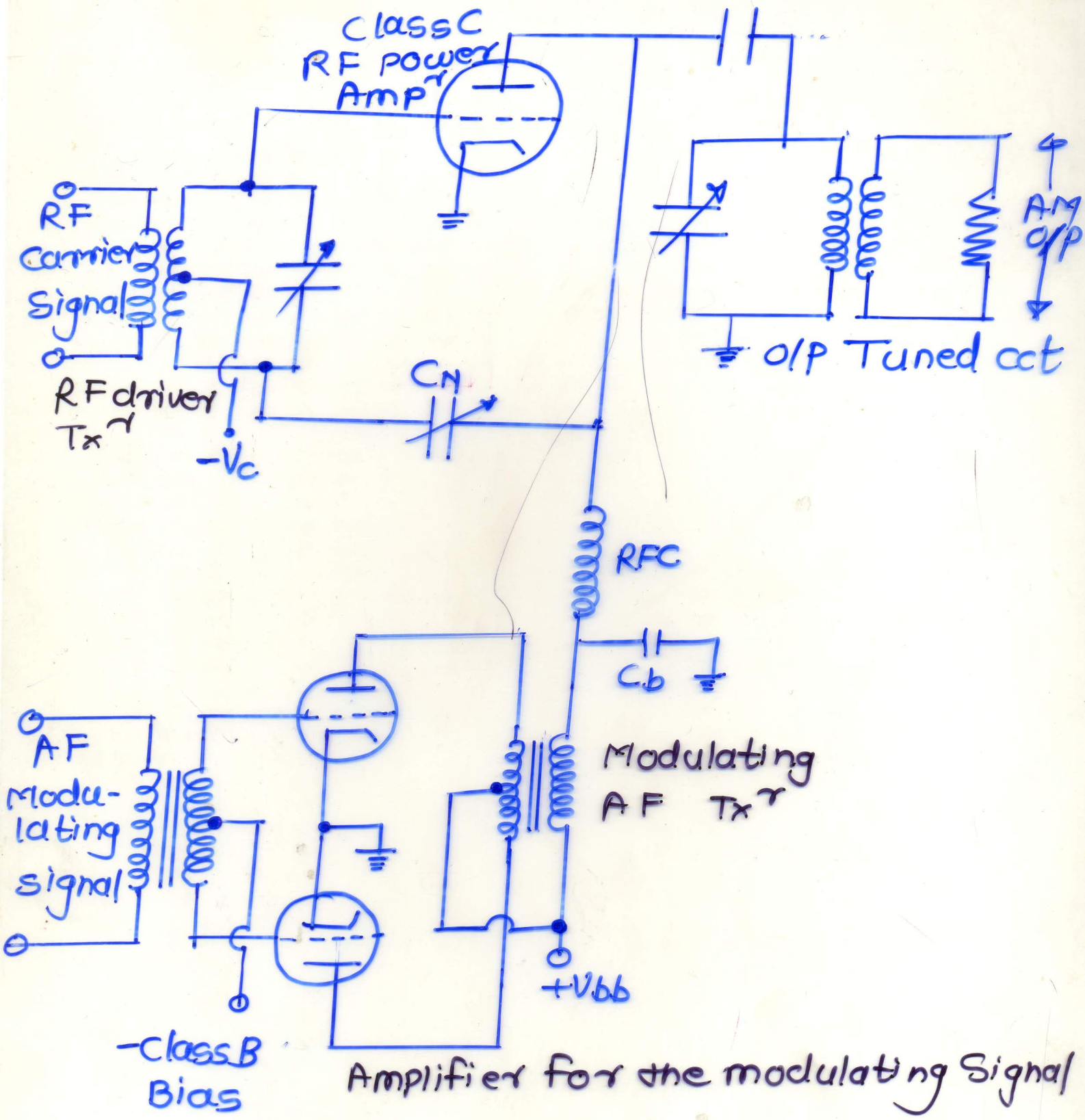
ADVANTAGES

① Lower modulating power is needed.

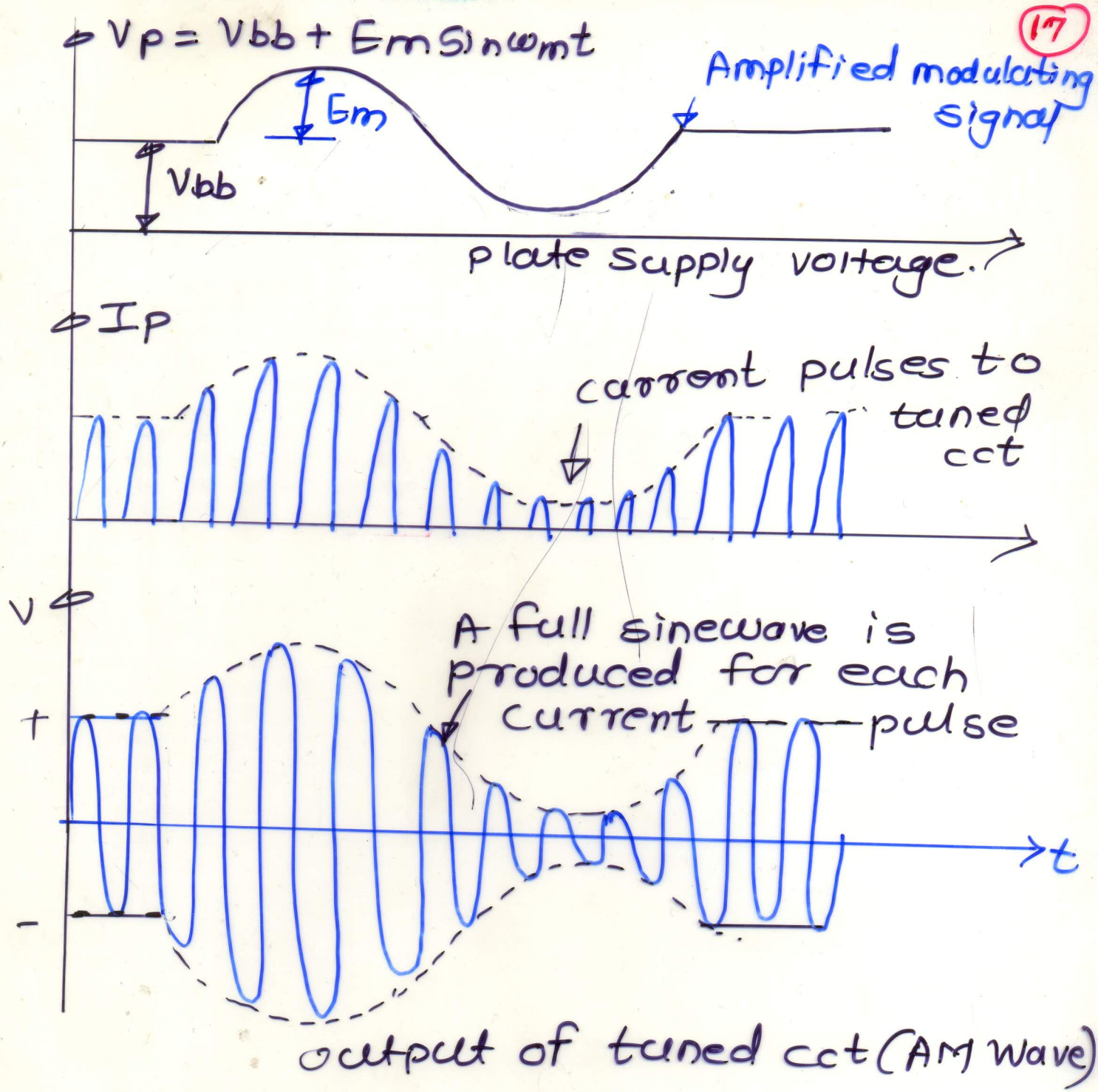
②

- Practically the grid modulation is not very often used to generate AM.

Plate modulated Class C Amplifier



Amplifier for the modulating Signal



waveforms for plate modulated class C Amplifier

- RF Transformer is used to apply Radio frequency carrier signal.
- RFC is radio frequency choke which offers high impedance to radio freq and low impedance to audio freq.
- Cb is used for extra safety. It acts as a short cct for radio freq if RFC fails to stop the high freq RF signal. So they will not enter in AF Transformer.
- Audio signals are amplified by class B pushpull power amp^r.
- This power amplified audio signal is connected in series with supply voltage $+V_{bb}$. So the total Bias voltage at plate is $V_{bb} + E_m \sin \omega m t$ it varies according to modulating signal. Hence called plate modulation.
- This will vary the height (amplitude) of the plate current pulses.
- These pulses are applied to tank circuit. Due to flywheel action we get AM wave.

- C_N is neutralizing capacitor At high freq inter-electrode capacitance (miller's effect) provide +ve feedback. So amp^r may turn into oscillator. So to avoid this C_N provides -ve feedback which nullifies +ve feedback.

- Important

It is not possible to obtain 100% modulation. ie $E_m = V_{bb}$ when modulating signal goes negative it subtracts from V_{bb}. At negative peak point subtraction is zero. So o/p becomes zero.

Advantages

1. better Linearity (No distortion)
2. Higher efficiency than grid mod^r
3. Higher power output than grid mod^r

Disadvantage

It requires more modulating power than grid mod^r.