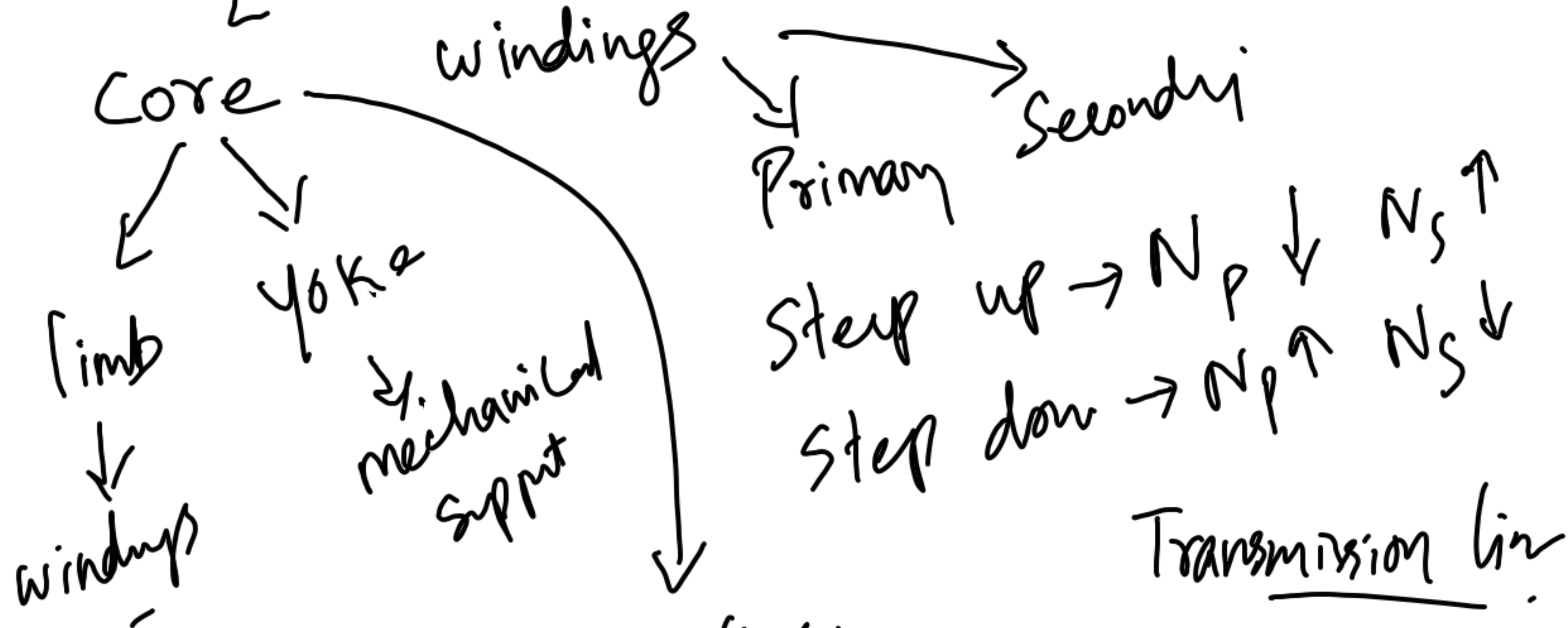


Transformer



- magnetic flux.
- number of sheets laminated.
- ↓ eddy current

Transmission line

↑ step ↓ ↓ ↓

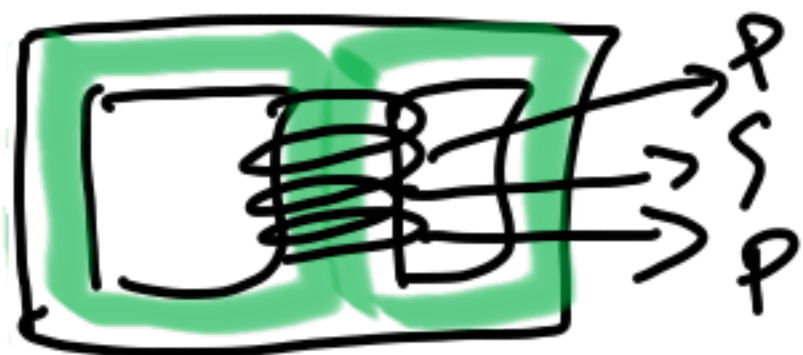
400kV, 272kV

Core

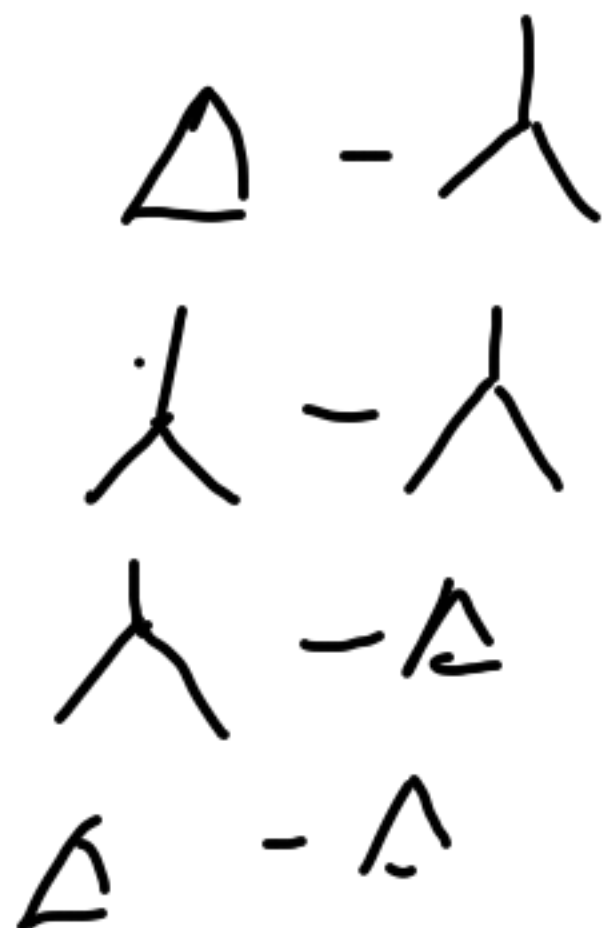


↑
low voltage

Shell



↑
H_gm



- Core
- winding
- insulator
- oil
- Conservator
- Breather.
- Buchholz Relay →
- Bushing.

$$E = -N \frac{d\phi}{dt}$$

$$\frac{E_p}{N_p} = \frac{E_s}{N_s}$$

$$E_p = V_p, \quad V_s = E_s$$

$$\frac{V_p}{N_p} = \frac{V_s}{N_s} \Rightarrow$$

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$\frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_p}$$

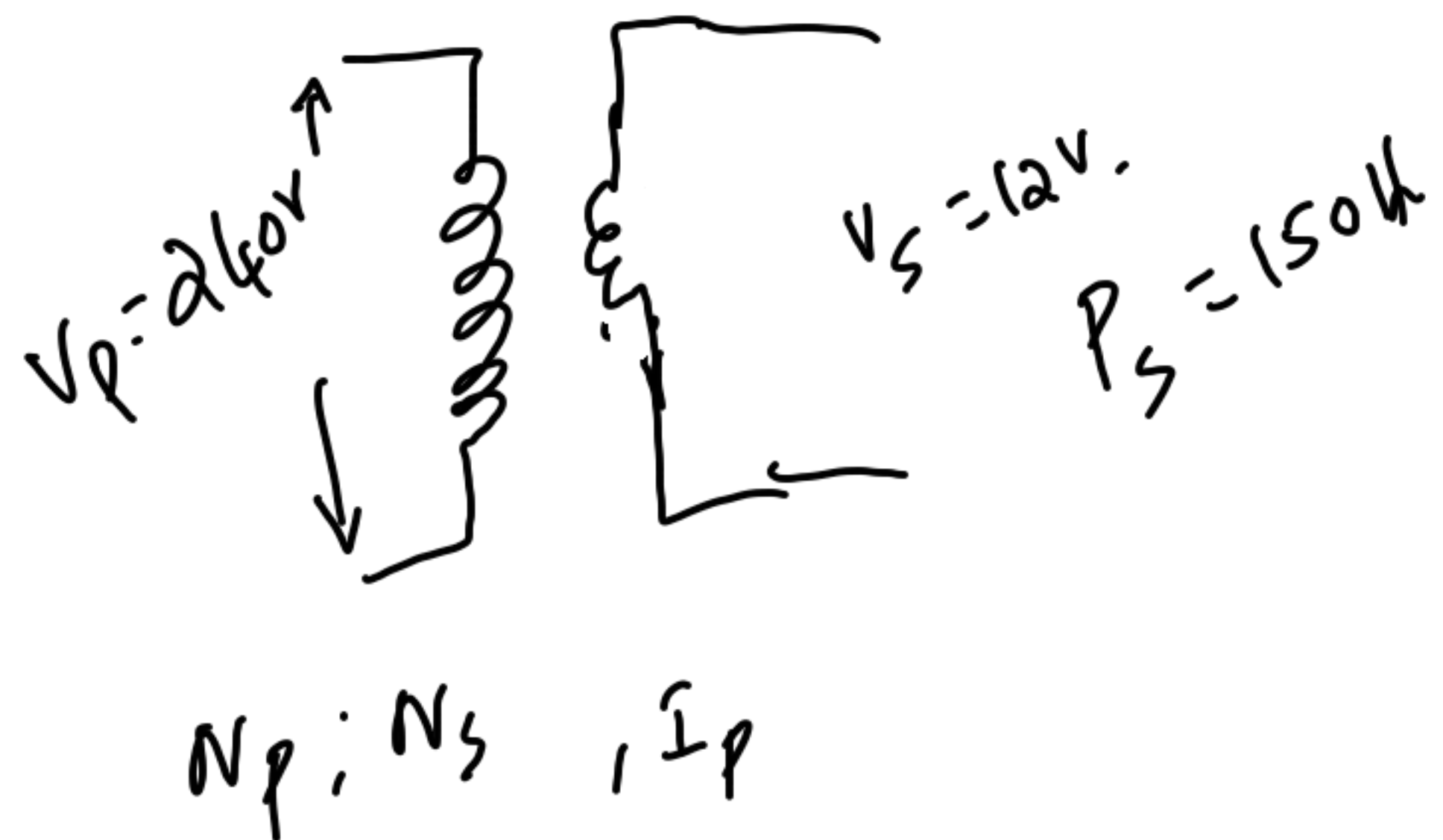
Power in = out power.

$$V_p I_p = V_s I_s$$

$$\frac{V_p}{V_s} = \frac{I_s}{I_p}$$

$$\eta = \frac{P_s}{P_p}$$

1) An ideal transformer connected to a 240V mains supplies a 12V, 150W lamp. Calculate the transformer turns ratio and the current taken from the supply.



$$P_s = V_s I_s$$

$$I_s = \frac{P_s}{V_s}$$

$$= \frac{150}{12}$$

$$I_s = 12.5A$$

$$\frac{V_p}{V_s} = \frac{240}{12} = 20$$

$$N_p = 20$$

$$N_s = 1$$

20:1

$$\frac{V_p}{V_s} = \frac{I_s}{I_p}$$

$$I_p = \frac{I_s V_s}{V_p}$$

$$I_p = \frac{12.5 \times 12}{240}$$

$$I_p = 0.625A$$

2) A transformer has 500 turns in its Primary Coil and is used to Step down a 240V AC voltage to 12V.

i) State the turn ratio and calculate how many turns would there be in the Secondary.

ii) Under full load, the current demand in the Secondary Circuit is 50A. Determine the output power rating.

iii) Determine the maximum load resistance that this transformer could supply.

iv) If we assume that the transformer is only 90% efficient, estimate the current in primary, for

The Condition Stated in (2, ii)

Soln.

$$N_p = 500$$

$$V_p = 240V$$

$$V_s = 12V$$

$$\frac{V_p}{V_s} = \frac{240}{12} = 20$$

$$N = 20.$$

To find N_s

$$\frac{N_p}{N_s} = N$$

$$\frac{500}{N} = N_s$$

$$\frac{500}{20} = N_s$$

$$N_s = 25 \text{ turns}$$

Turns Ratio.

$$500:25$$

$$20:1$$

$$\begin{aligned} \text{ii) } P_s &= V_s I_s \\ &= 12 \times 50 \end{aligned}$$

$$P_s = 600 \text{ W}$$

$$\text{iii) } R_L = \frac{V_s}{I_s} = \frac{12}{50} = 0.24 \Omega.$$

$$\text{iv) } \eta = \frac{P_s}{P_p}$$

$$0.90 = \frac{600}{P_p}$$

$$P_p = \frac{600}{0.90}$$

$$P_p = 666.67 \text{ W}$$

$$I_p = \frac{P_p}{V_p}$$

$$I_p = \frac{666.67}{240}$$

$$I_p = 2.78 \text{ A}$$