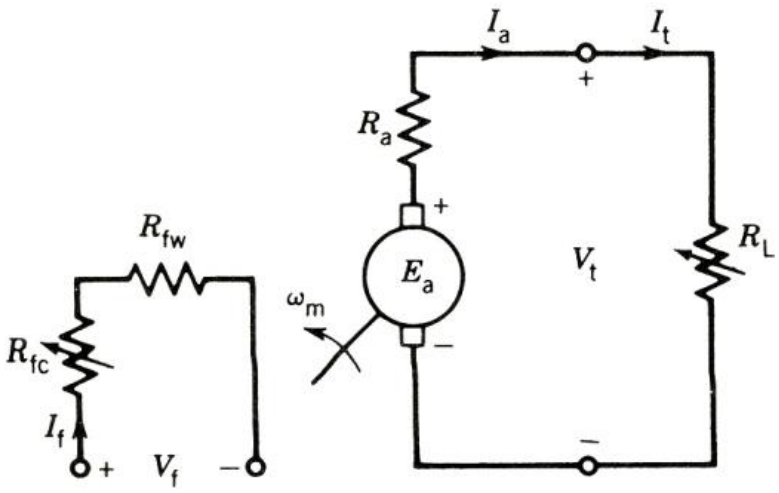

Fig. 1. Separately excited DC generator

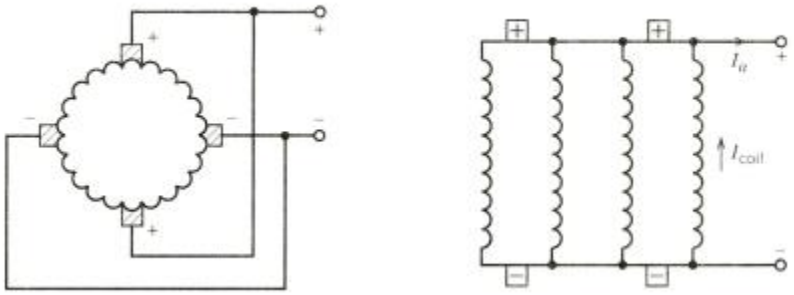

Fig. 2. lap winding of armature

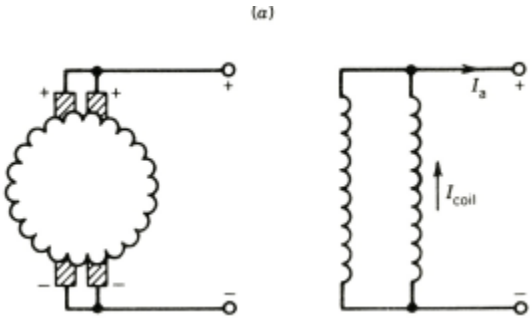

Fig. 3. wave winding of armature

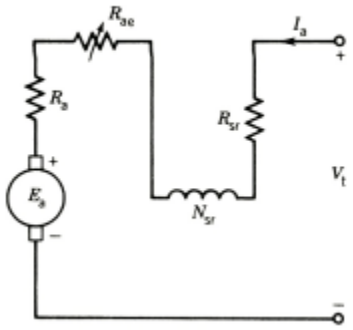

Fig. 4. Series dc motor

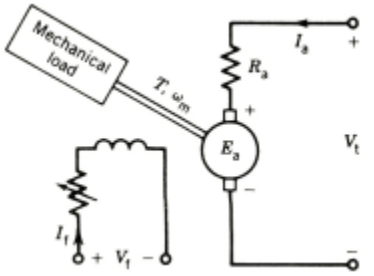

Fig .5. separately excited dc motor

$$K_a = \frac{Np}{\pi a}$$

$$K_a = \frac{Zp}{2\pi a}$$

Please note that Z is the total number of conductors in the armature winding.

Electrical power, $E_a I_a = K_a \Phi \omega_m I_a = T\omega_m$, mechanical power

$$A = \text{area per pole} = \frac{2\pi rl}{p}$$

$$I_a = \frac{V_t - E_a}{R_a}$$

$$E_a = K_a \Phi \omega_m = V_t - I_a R_a$$
$$T = K_a \Phi I_a$$

$$\omega_m = \frac{V_t - I_a R_a}{K_a \Phi}$$

$$\omega_m = \frac{V_t}{K_a \Phi} - \frac{R_a}{(K_a \Phi)^2} T$$

Accordingly how can we control the speed?