Chapter 3: Speed control of D.C Motor.

1 - Factors control Motor speed

$$Eb = V - I_a R_a \quad , \quad Eb = \phi Z N \frac{P}{A}$$

$$\therefore \phi = 1$$

$$K = Z \frac{P}{A}$$

$$\boxed{N = K \frac{V - I_a R_a}{\phi}}$$

$\because N \propto \frac{1}{\phi}$, N is increased with ϕ decreace and vice-versa

Not: This method used to increase and decrease speed over and under the normal speed

* In small Motors the control ratio is (2:1) motor with out interpolse.
* In large motor that used interpole speed can be increased in the ratio (6:1)
* By using Ward-Leonard system is wide range of control speed and has ratio (10:1)

اعداد الطالبة: أحمد سعادين

$$\frac{N_2}{N_1} = \frac{Eb_2}{Eb_1} * \frac{\phi_1}{\phi_2} \quad , \quad \frac{\phi_1}{\phi_2} = \frac{I_{sh1}}{I_{sh2}}$$

① Speed control by change the flux ϕ $\left(N \propto \frac{1}{\phi}\right)$. this method is simple to Dane by insert Variable resistance in the filed circuit.

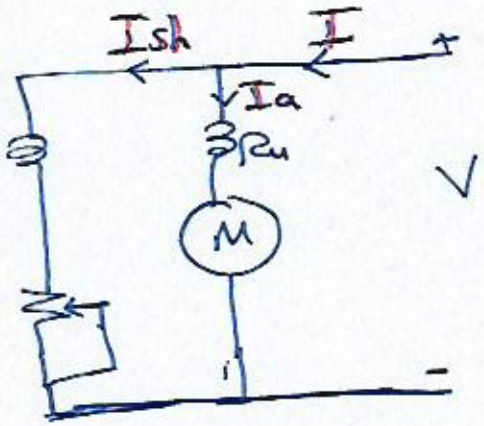
I_{sh} is small $\Rightarrow$ R is small size.

$\boxed{T_a \propto \phi I_a}$ $\quad T_{a1} \propto \phi_1 I_{a1}$, $T_{a2} \propto \phi_2 I_{a2}$

if Torque is constance with chang speed $\Rightarrow T_{a1} = T_{a2}$

$\boxed{\therefore \phi_1 I_{a1} = \phi_2 I_{a2}}$

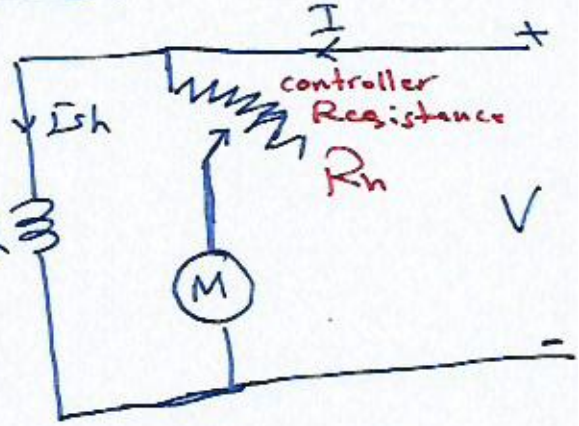
a) Shunt Motor



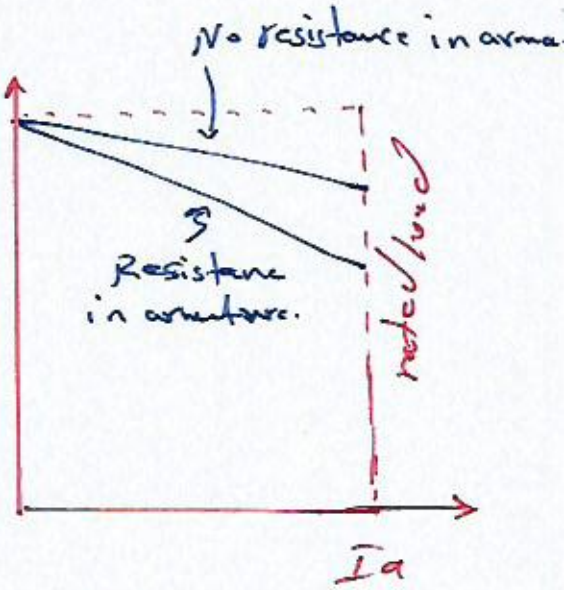
استاذ المادة : أ. محمد سلمان

(2) Armature oR Rheostatic control Method.

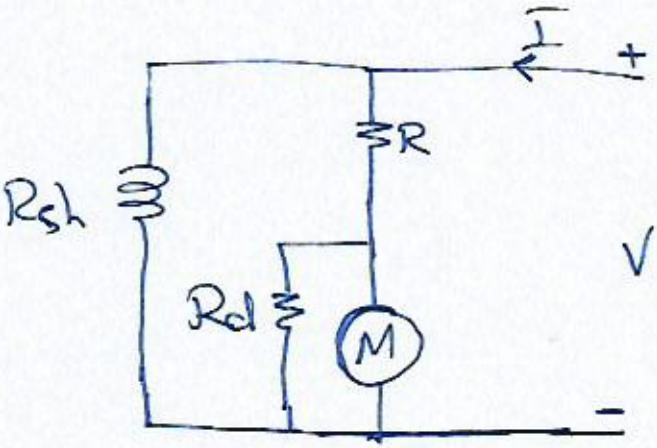
Note :- This method is used when speeds below the No-Load speed are required.



$R_h \uparrow\uparrow \Rightarrow$ Pd across the armature is decreased due to speed is decreased also.



* Rh is caused the motor speed unstable with load change is this case we used diverter across the armature show in fig below



Ex : 30:29

Speed control of series Motors

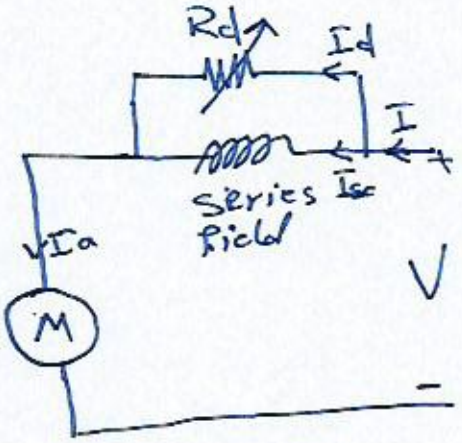
1- Flux control Method :-

Variations in the flux of a series motor can be brought about in any one of the following ways:

a) field diverters :-

Rd: by adjusting the current Ise is change therefore flux is change ⇒ speed is change

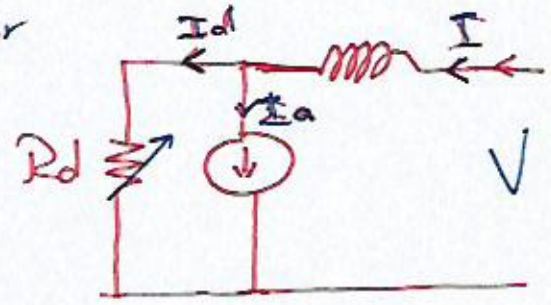
- $\phi\uparrow \Rightarrow N\downarrow$. $\phi\downarrow \Rightarrow N\uparrow$



b) Armature diverter :-

A diverter across the Armature can be used for giving speeds lower than the normal speed.

if Ia is reduce due to Armature diverter the ϕ must increase



$\because$ $Ta \propto \phi Ia$

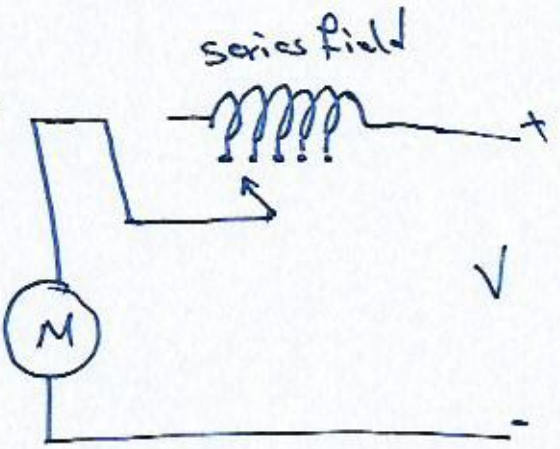
$N \propto I/\phi$

The variation in speed can be controlled by varying the diverter

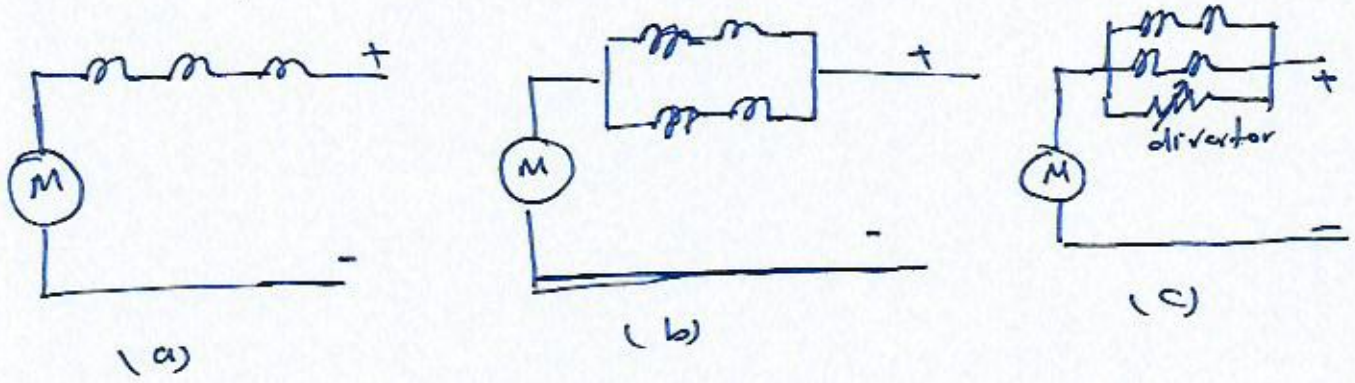
c) Trapped field control field.

this method is often used in electrical traction

- by cutting out some of the series turns the flux (ϕ) is decreased and ~~spe~~ Motor speed is increased and vice versa.



d) Paralleling field coils



- In this method ~~need~~ several speed can be obtained by regrouping the field coils.

2) Variable Resistance in series with Motor

R increased

the Voltage across the Armature is decreased. in order to speed is decreased.

at full load the motor current passing through the resistance in the case the Losses power should be considerable.