Application of Ward Leonard System

This **Ward Leonard method of speed control system** is used where a very wide and very sensitive speed control is of a DC motor in both the direction of rotation is required. This speed control system is mainly used in colliery winders, cranes, electric excavators, mine hoists, elevators, steel rolling mills, paper machines, diesel-locomotives, etc.

Advantages of Ward Leonard System

1. It is a very smooth speed control system over a very wide range (from zero to normal speed of the motor).
2. The speed can be controlled in both the direction of rotation of the motor easily.
3. The motor can run with a uniform acceleration.
4. Speed regulation of DC motor in this ward Leonard system is very good.
5. It has inherent regenerative braking property.

Disadvantages of Ward Leonard System

1. The system is very costly because two extra machines (motor-generator set) are required.
2. Overall efficiency of the system is not sufficient especially if it is lightly loaded.
3. Larger size and weight. Requires more floor area.
4. Frequent maintenance.
5. The drive produces more noise.

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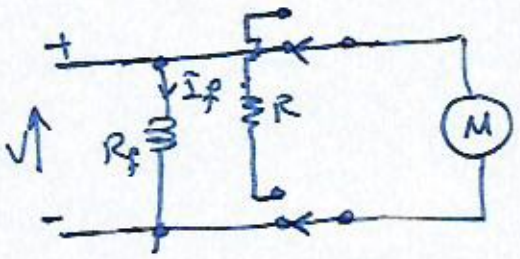
DC Machines

Braking «stopping» of DC Motor

Large motors with haavy loads may take very longe time to coast to a stop. The motor it self however, can be used to slow the rotation. There are three methods used for electro mechanical braking are [dynamic braking , plugging , Regenorative Bra

1. dynamic Braking :-

a) shunt Motor.-

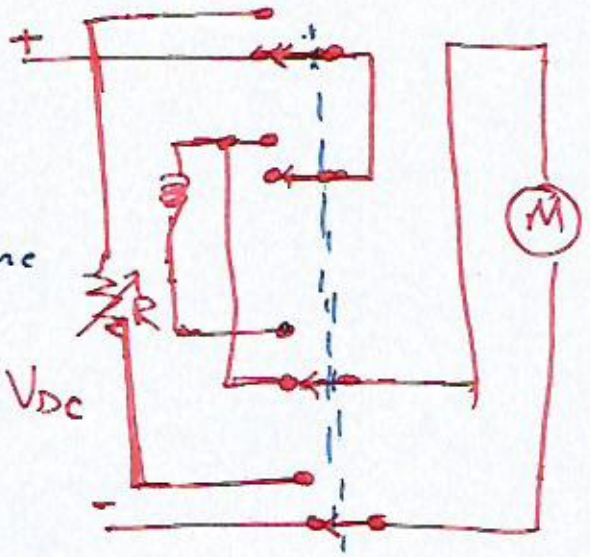


the armature of a shunt motor is disconnected from the line and connected to resistor

The motor armatur is still rotating within a magnet field and therefore producing an armature voltage due to generator action. If the armature circuit is completed through a resistor, current will flow and a counter torque will be produced. This counter torque will slow the motor. As the motor slow down the counter torque will decrease because the current

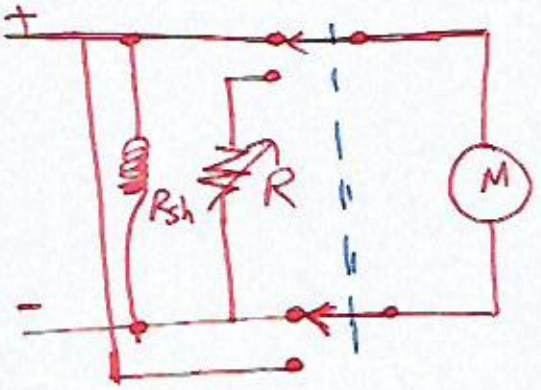
is decreasing. Therefore, most of the slowing effect occu at higher speeds.

b) Series motor :- the motor disconnected from the supply, the field connection are reversed and the motor is connected in series with variable resistance (R), now, the Machine is running a generator.

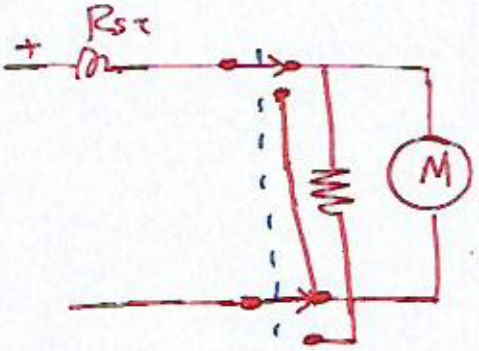


2) Plugging :-

a) Shunt Motor :- plugging occurs when the armatur is dis connected from the line and then is re connect to the line in the opposite direction. This techni causes the motor to slow down very rapidly when the motor comes to rest. it is automatically dis connect from the power line.

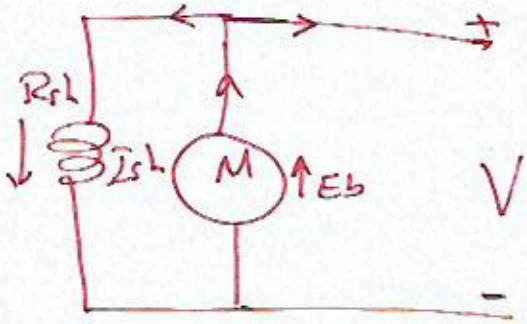


b) Series Motor:- the connections of the armature are reversed and a variable resistance R is put in series with the armature to limit the armature current. to reasonable value.



c) Regenerative Braking

this method is used when the load on the motor has overhauling characteristic as the down grade motion of an electic trian. Regenerative takes place when Eb become greater then V. This happens when the overhauling load acts as a prim-mover and so drives the machine a generator. Consequently, direction of Ia and hence of armature torque is reversed and speed falls until Eb become less then V.



DC Motor Starting

استاذ المادة: أ/ العيساوي

① full voltage starting (starter)

② Three / Four point starting (starters)

* To start any motor two requirements must b
met

a) protection from flow of excessive curren
during the starting period.

b) starting torque should be made as large
as possible

* High armature current.

the armature current is given by:

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

* Three factors limiting the armature curren

1- Terminal voltage (V)

2- Eb (back emf)

3- Armature resistance. (Ra)

R inserted in armature circuit No effect on field
$T \propto \phi I_a$

Eb is very small upon starting ⇒ $N \simeq$ zero.

→ the Armature current used by the Armature is very high.

* Inserting a starting resistance in series with the armature, reduce the high starting current.

Starting Resistance

- motor is stationary.
- Eb is Zero.
- only Ra is limit the current drown from Armature.

Ex Consider a 10 HP motor with armature Resistance = 0.44Ω and connect to 220V supply

$$I_a = \frac{V - E}{R_a} = \frac{220 - 0}{0.44} = 500\,A$$

* This large inrush current (10 times full load current would in all probability damage the motor winding, brushes, Insulation.

* So, the external resistance or some other voltage reduction method is placed in series with motor armature