SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 23EEB201/ Electrical Machines and Drives

II YEAR / IV SEMESTER

Unit II – ELEC4TRICAL MOTORS

Topic : Electrical braking and its types

Electrical braking and its types

The DC motors can be stopped using one of the following methods:

- Mechanical (Friction) Breaking
- Electric Breaking

In **mechanical breaking**, the motor is stopped due to friction between the moving parts of the motor and the break shoe. The mechanical breaking has several disadvantages as non-smooth stop, wear and tear of moving parts, breaking power wasted as heat and greater stopping time etc.

Types of Electric Breaking

In **electric breaking,** the kinetic energy of moving parts of the motor is converted into electrical energy which is either dissipated in a resistance or returned to the supply source.

Types of Electric Breaking

There are three types of electric breaking methods of a DC motor

- Rheostat Breaking or Dynamic Breaking
- Regenerative Breaking
- Plugging or Reverse Current Breaking

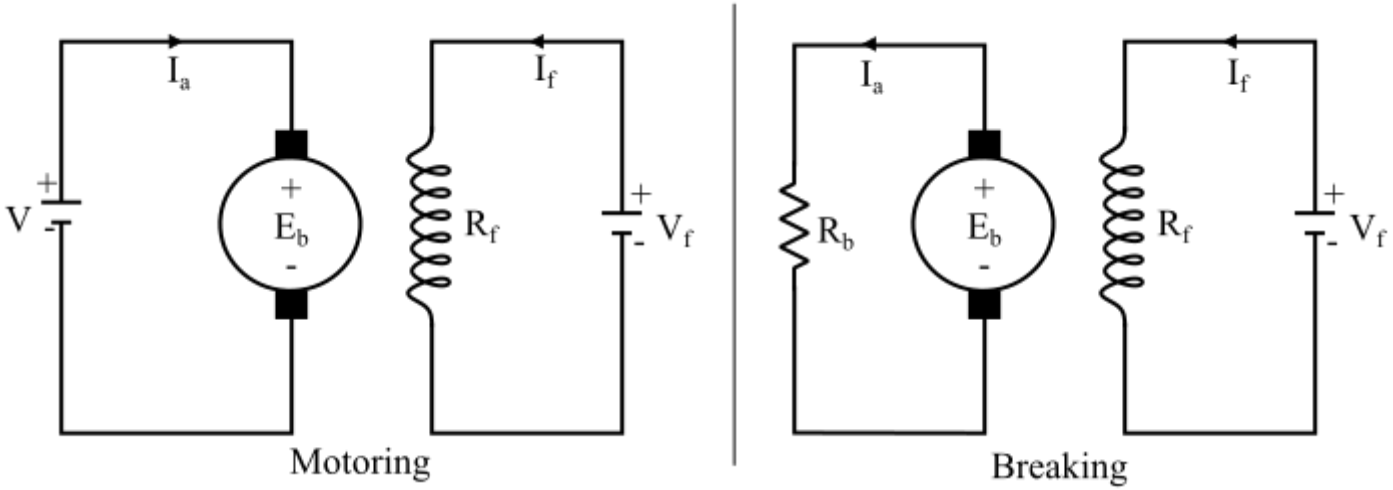
Rheostat Breaking or Dynamic Breaking

- In **dynamic breaking**, the armature of running DC motor is disconnected from the supply and is connected across a breaking resistance R_b.
- However, the field winding is left connected to the supply.
- Hence, the motor now works as a generator and producing a breaking torque.
- This method is also known as **rheostat breaking** since an external resistance R_b is connected across the armature for the electric breaking.

Rheostat Breaking or Dynamic Breaking

- During dynamic electric breaking when the motor works as a generator, the kinetic energy of moving parts of the motor is converted into electrical energy and is dissipated in the form of heat in the breaking resistance R_b and the armature circuit resistance R_a. As a result, the motor is brought to standstill quickly.
- The dynamic breaking or rheostat breaking is an inefficient method of breaking since all the generated energy is dissipated in the form heat in the resistance.

Rheostat Breaking or Dynamic Breaking



Regenerative Breaking

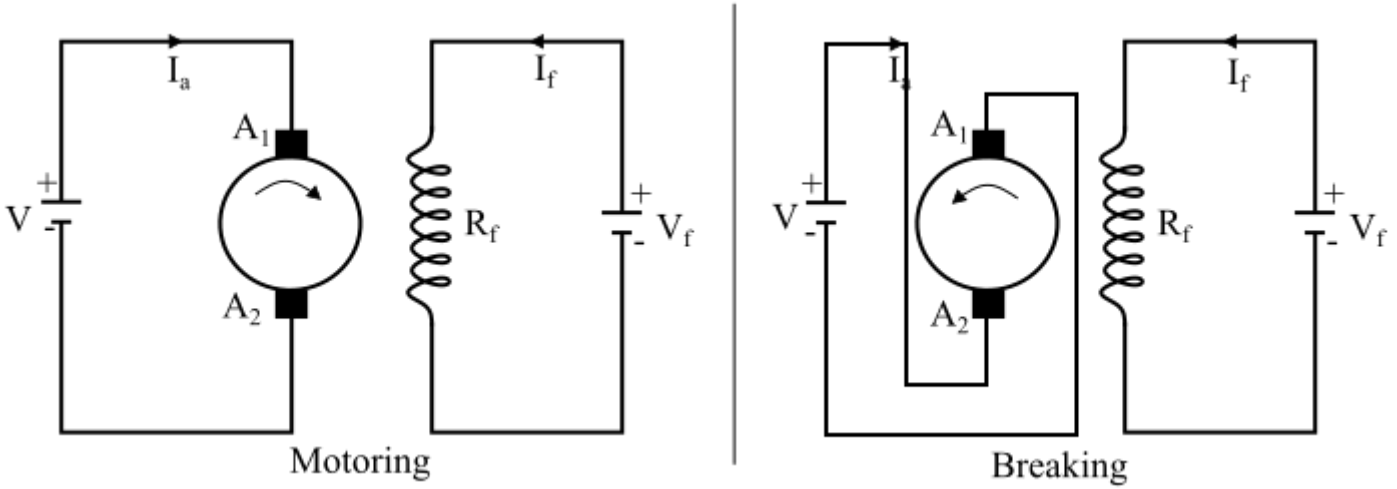
- In regenerative breaking, the motor is operated as a generator so the kinetic energy of the moving parts of the motor is converted into electrical energy.
- This electrical is then returned to the supply source. This action slows down the motor.
- The regenerative breaking is only possible when the driven load forces the motor to run at a speed greater than the no-load speed with a constant field excitation.
- Under this condition, the back EMF (E_b) of the motor is more than the supply voltage, which reverses the armature current of the motor.
- Therefore, the motor now beings to operate as a generator and the generated electrical energy is transferred to the supply source.

Regenerative Breaking

- The regenerative breaking cannot be used for stopping the motor. It is just used for controlling the speed above the no-load speed of the DC motors.
- The necessary condition for the regenerative breaking is that the back EMF of the motor must be greater than the supply voltage, so that the armature current is reversed and the motoring operation is changed to the generating operation.
- The regenerative breaking is mainly used to control the speed of DC motors driving the loads such as electric locomotives, elevators, cranes and hoists etc.

Plugging or Reverse Current Breaking

In the **plugging or reverse current breaking**, the connections of the armature are reversed so that the motor tends to rotate in the opposite direction and provides the necessary breaking effect. When the motor comes to rest, the supply source must be disconnected otherwise the motor will start rotating in the opposite direction.



Plugging or Reverse Current Breaking

When the armature connections are reversed, the supply voltage and the back EMF will act in the same direction. Hence, during the breaking the resultant voltage across the armature will be equal to $(V + E_b)$, which is approximately double of the supply voltage. This reverses the armature current and hence a high breaking torque is produced. To limit the armature current to a safe value, a current limiting resistor is connected in series with the armature.

The plugging is a highly inefficient method of breaking since the power supplied by the moving parts as well as power supplied by the source is wasted in resistances.

The plugging is mainly used in controlling rolling mills, elevators, machine tools and printing presses etc.