Braking

When a locomotive is running at certain speed and if it is to be stopped within a short distance brakes are to be applied. For this purpose brake shoes are provided which are pressed against the wheels for retardation. Steam and diesel locomotives have pneumatic braking system. Some electrical methods of braking have also been devised which are used mainly to step electric motors. During electric braking the kinetic energy of the motor and the coupled mechanism is steadily dissipated in some form or other and the speed of the machine goes on reducing. Four method of electric braking are:

1. Magnetic braking :

In this case the excitation of the armature is disconnected from the supply but the excitation remains on. When the armature rotates in the fixed field, there is reversal of flux in the armature and the iron losses are fed from the kinetic energy of the rotating components and the machine retards. This method can be adopted for shunt, compound „and synchronous motors. In case of series motors the field cannot stand the full rated voltage, so separate battery has to provided for excitation during braking.

2. Plugging :

In this case the connections of excitation are reversed. The motor tends to rotate in the reverse direction. Care should be taken to disconnect the motor when it has just stopped This method can be used for small motors and is not suitable for traction motors which are generally of large size.

3. Resistance braking :

In this the motor after switching off is made to run as a generator. The output of generator is consumed in resistance thereby causing retardation.

4. Regenerative braking :

In this method although motor is made to run as a generator but the current instead of being fed to a resistance is fed to the mains. The essential condition for this is that the induced emf should be slightly more than the supply voltage. This method of braking cannot be used for synchronous motors.

Requirements of braking system :

Before we deal with various systems of braking we will first enumerate various desirable requirements which a braking system should satisfy. These are:

1. The braking system should be robust, simple and easy for driver to control and operate. It should require less maintenance and should be reliable.

2. The system should apply brakes simultaneously over all the vehicles.

3. Brake actuation time should be as small as possible.

4. To avoid damage to the goods and discomfort to the passengers, normal service application of brakes should be very gradual and smooth.

5. In case of emergency braking, safety consideration is the prime most consideration. As such retardation rate would be maximum consistent with the safety, so as to make unfailing halt in the minimum possible distance.

6. In order to obtain uniform deceleration, braking force applied to the axle should be proportional to axle load.

7. The braking system should be inexhaustible i.e. repeated quick application of brake should be possible without needing any relaxation, recuperation or normalizing time in between consecutive operations.

8. Kinetic energy of the train should as far as possible be stored during braking which could subsequently be utilized for accelerating the train.

9. There should be automatic slack adjustment for constant piston stroke as a result of wear on the rim and the brake blocks in the case of mechanical braking.

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