(7) *Well wagon:* This wagon is used to transport the bulky articles of excessive height.

(8) *Refrigerated wagon:* This wagon is used to transport perishable goods such as milk. The wagon is airtight and special equipments such as cam-operated spring doors, suitable flooring, insulation of cork, a bunk of ice, blower fans, etc. are provided to make the wagon airtight.

(9) *Special wagons:* The RDSO has designed special types of wagons for carrying certain goods. The wagon known as STUD-END type has been designed for Fertilizer Corporation of India. Similarly BOX and BOX *N* types of wagons fitted with air brakes have been designed to run heavy freight trains upto 7500 t or 75 000 kN trailing loads at a speed of upto 90 km p.h. Box *N* is an all-welded bogie wagon with a carrying capacity of 59 t or 590 kN and a tare weight of 22.5 t or 225 kN. Such wagons will enable large quantities of coal and minerals to be carried over busy trunk routes.

The railways have evolved design of *three* piece cast steel bogie called *CASNUB* having the advantages of lighter weight compared to the fabricated bogie, trouble-free service and less prone to the bogie cracks and spring failures.

The more recent designs of the wagons are provided with cartridge bearings which require no lubrication in between and are much more reliable.

Train-brakes:

The brakes to a moving train are applied from the locomotive. They are mainly of *three* types, namely:

(1) Hand brakes
(2) Steam brakes
(3) Continuous automatic brakes.

The hand and steam brakes are still in use at present for the locomotive itself only. They cannot be used to stop a moving train at high speed, for which continuous automatic brakes are adopted. The continuous automatic brakes are of the following *two* types:

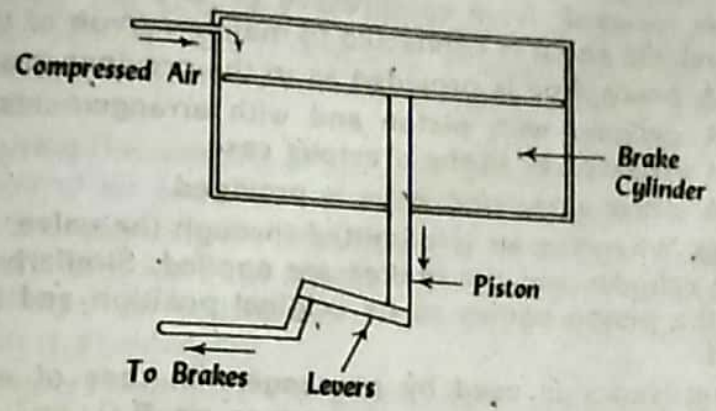
(1) Compressed air brakes
(2) Vacuum brakes.

The principal features of these *two* types of train-brakes are discussed below.

(1) *Compressed air brakes* (fig. 3-11):

Essential parts: Following are the essential parts of a compressed air brake:

(a) An *air-pump* in the locomotive is provided. It is operated by steam and it compresses air into a main reservoir situated in the locomotive.



Compressed air brake
FIG. 3-11

(b) A *brake-pipe* is provided running from the main reservoir to the back side of the locomotive and then under each vehicle. The pipes are fitted with flexible connections.

(c) A *brake cylinder* containing piston is provided under each vehicle. This cylinder is connected to the brake pipe and it operates the brakes by a system of levers.

Working: When the compressed air is admitted into the cylinder at top from brake-pipe, the piston moves down and the brake is applied to the moving vehicle. Similarly, when the pressure of the compressed air is reduced, the piston returns to its original position and the brakes, applied to the vehicles, are released.

Defects: This type of brake is now not adopted mainly because of the following *defects*:

(a) If the train is long, the time required for the compressed air to reach the last vehicle would be considerable and in case of emergency-stop, this delay might prove to be fatal.

(b) The entire system gets dislocated, if there is bursting of air-pipe under any vehicle and if such thing happens during an emergency-stop, the accident becomes fatal.

(c) If by chance, the train gets divided into *two* parts, the front portion of the train gets power to operate the brake while the rear portion does not get the required power and this results in dangerous collision of the rear portion with the front portion of the train.

(2) *Vacuum brakes* (fig. 3-12):

Essential parts: Following are the essential parts of a vacuum brake:

(a) A *reservoir* from compressed air is provided under each vehicle and it is connected to main reservoir of the engine.

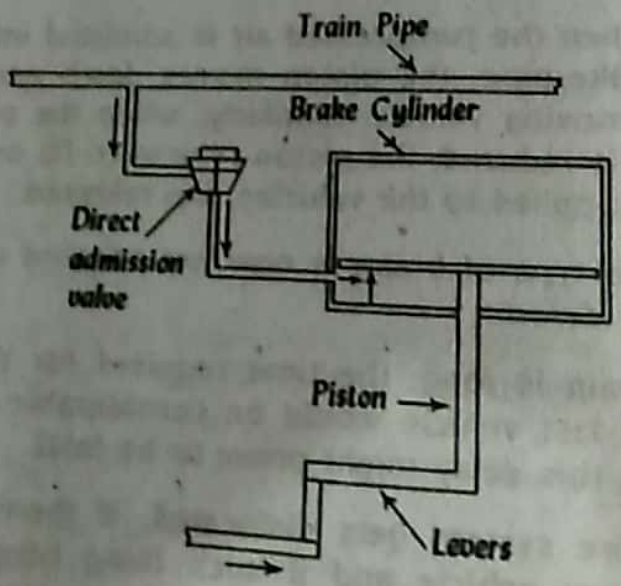
(b) A *brake-pipe* is provided as in the previous case.

(c) A *cylinder* with piston and with arrangements of levers is provided as in the previous case.

(d) A *direct admission valve* is provided.

Working: When the air is admitted through the valve, the piston rises in the cylinder and the brakes are applied. Similarly, when air is sucked, the piston comes to its original position and the brakes are released.

This contrivance is used by passengers in case of emergency. For this purpose, every passenger carriage on B.G. and M.G. lines is provided with a handle and chain. The arrangement is made in such a way that when a passenger pulls the alarm chain, the vacuum inside the brake cylinder breaks as air enters suddenly. This makes piston to rise and thus brakes are automatically applied. The chain runs for the whole length of the coach and when pulled, it gives out a shrill whistle sound at the coach end for easy identification of the vehicle concerned. The vestibuling of coaches had made the access to all the coaches on a train an easy matter.



Vacuum brake

FIG. 3-12

In order that a train guard can bring the train to a stop in case of emergency, a valve is provided in his compartment. He opens the valve slowly in case of emergency which gradually reduces the vacuum and the brakes are then gradually automatically applied.

Advantages: This brake is now-a-days universally adopted because of its many advantages. The defects of the above type are totally removed by this type of brakes as shown below:

(a) When the pressure in brake-pipe is reduced, the valves under each vehicle start functioning automatically and operate the piston. Consequently the brakes are applied almost simultaneously on all vehicles.

(b) During the bursting of air-pipe, the brakes are at once applied due to entry of air and thus it is possible to detect the defect.

(c) If by chance, the train breaks into *two* parts, both the portions will at once have all the brakes applied automatically and thus the dangerous collision of rear portion with the front portion of the train is avoided.

It is understood that the alarm chain apparatus on the Indian railways was adopted around 1905 and at present, about 700 cases of alarm chain pulling per day occur on the Indian railways. The misuse of this facility by the unsocial elements such as smugglers, criminals, ticketless travellers, etc. has been causing serious concern to the authorities. So also there is a class of people who for mere satisfaction of their personal whim and ego may cause disturbance in the smooth working of the railways by pulling the alarm chain. The prominent persons among this class are some of the office-goers and students. Hence, in most of the cases of alarm chain pulling, the guard on duty has to record. CNF (Culprit Not Found) in his diary.

Dynamometer car:

This is a car or vehicle containing dynamometer and other apparatus, giving valuable information regarding the condition of the track. The dynamometer car is placed between the locomotive and the train. An automatic graphic record is made by the equipment known as the *Hallade recorder*. It is a portable instrument and produces a graphic chart of the various parameters of track over which it is carried in a train. The instrument consists mainly of the following *two* mechanisms:

(1) *Rotating drum:* It is fixed in position and 100 mm wide paper strip is wrapped on the rotating drum for plotting the graph.

(2) *Pendulums:* There are four sets of pendulums and they control the movement of four needle points which are called styles.

The instrument records the following track details:

(1) *Physical features:* These include stations, towns, kilometre points, bridges, etc.

(2) *Rolling parameters:* These include differential packing, cross-levels, low joints, acceleration and deceleration of the vehicles.