INVESTIGATION OF AUTOMATIC BRAKING SYSTEM OF REMOVED RAILWAY COACHES

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Abstract*—The air brake system is one of system used for accurate operation in trains. Air compressors mounted every two to four coaches supply compressed air to the air brakes. The air, which is compressed to nearly 8 Kg/sq cm, is piped below coach floors to main air reservoirs. The air pressure is lowered to 5 Kg/sq cm which pressure regulated and air is fed via the brake valve, brake pipes, and control valves to auxiliary air reservoirs. If the compressed air in the pipes and auxiliary air reservoirs of coach is at 5Kg sq cm, brakes are not activated. The activated brake valve cuts the flow of air from pressure regulated and air pressure in the brake pipes falls. The fall in air pressure is detected by the control valves on each coach.*

INTRODUCTION

The brakes are used on the coaches of railway trains to enable deceleration, control acceleration or to keep them standing when parked. While the basic principle is similar from road vehicles, usage and operational features are more complex because of the need to control multiple linked carriages and to be effective on vehicles left without a prime mover. In the control of any braking system important factors that govern braking action in any vehicle are pressure, surface area in contact, amount of heat generation and braking material.

LITERATURE REVIEW

S.Azahuraja, P.Maluventhan, A.Karneswaran, N.M.Mohankumar**[1]**"Indication Light For Hand Brake On Position In GSLR" in International Journal of Engineering and Advanced Technology(IJEAT) has discussed about indication light when applying hand brake using limit switch connected to brake level. Izumi hasegawa, Seigo Uchida**[2]**"Braking Systems" in International Journal of Engineering and Advanced Technology (IJEAT) has discussed about various braking system that are required for different braking operation that are adaptable for different environment.

Yonghuazhu, Weilieshang,**[3]**"Research On Braking Process Of High-Speed Train With Aerodynamic Brake" has discussed about to ensure safety of a new generation train running in high speed at this paper the braking force, braking time, ressistance are tested with and without brake wing as an analysis the brake wing made more contribution to ensure effective opertation.

AIR BRAKE SYSTEMS

1. Automatic Air Brake System

An automatic air brake system is Air compressors mounted every two to four coaches supply compressed air to the air brakes. The air, which is compressed to nearly 8 kg/sq cm, is piped below coach floors to main air reservoirs. The air pressure is lowered to 5 kg/sq cm with pressure regulator and air is fed via the brake valve, brake pipes, and control valves to auxiliary air reservoirs. If the compressed air in the brake pipes and auxiliary air reservoirs of each coach is at 5 kg/sq cm, brakes are not activated. The activated brake valve cuts the flow of air from the pressure regulator and air pressure in the brake pipes falls. The fall in air pressure is detected by the control valves on each coach. The control valves then regulate the flow of compressed air from auxiliary air reservoirs to break cylinders. The brake cylinders activate the basic braking mechanisms to slow down and stop the coach. The control valves regulate the flow of air from the auxiliary air reservoirs to the brake cylinders at a pressure that is proportional to pressure drop in the brake pipes.

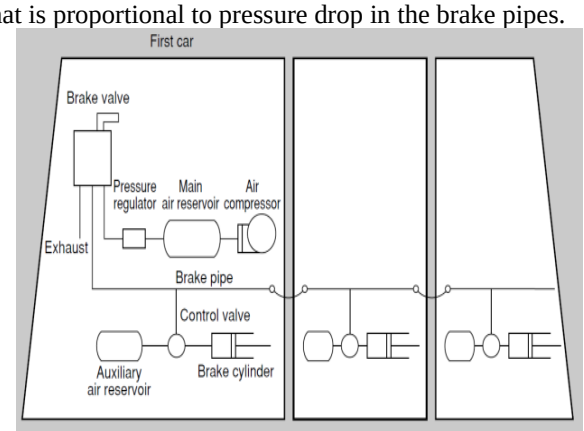

Fig.1Automatic Air Brake System

2. Straight Air Brake System

The straight Air Brake System is one of the consistent braking system that do not have auxiliary or control valve to regulate the brake pressure as that of automatic braking system. The braking mechanism is done by pressure flow through straight pipe to brake cylinder. As the straight pipe does contain sufficient air in brake cylinder during normal running condition there is a tendency of brake failure in the coaches are uncoupled. In order to avoid this, the straight air brake system may be

used in conjunction with the automatic air brake system. The tendency of brake failure can be avoided by using straight pipe graduated to main reservoir from first to last coaches. The air pressure in main air reservoir pipe acts like the compressed air in the brake pipes of the automatic air brake system. If compressed air in this main air reservoir pipe falls, or if it leaks from air pipes or from air hoses between coaches, etc., pressure drop is detected and brakes are applied automatically.

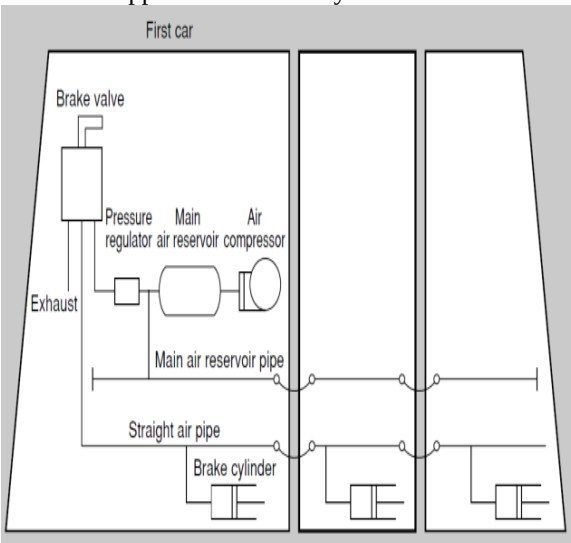

Fig.2Straight Air Brake System

Air brake system may also be classified as follows:

- Direct release air brake system
- Graduated release air brake system

Direct release air brake system is most suitable for leveled track or constant gradient route. Due to this reason it is not suitable for Indian Railways. Graduated release air brake system is most suitable for Indian Railways. In graduated release air brake system the brake pressure is applied and released such that the magnitude of braking force is proportional to reduction in brake pipe pressure. Graduated release air brake system can also be divided into two categories.

- Single pipe graduated release air brake system
- Twin pipe graduated release air brake system

3**.** Single Pipe Graduated Release Air Brake System:

Single Pipe Graduated Release Air Brake System is shown in Fig. 3. This system is same that of twin pipe graduated system except the auxiliary is charge through D.V. hence there is no feed system is this method. By combining single and double pipe graduated system the double pipe graduated system is more suitable for passenger travelling coaches.

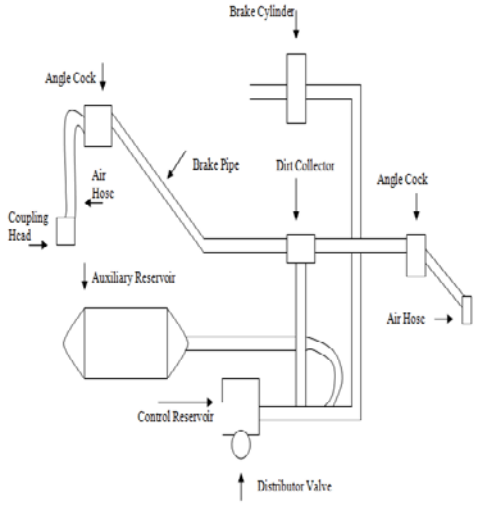

Fig.3 Single pipe ReleaseAir Brake System

4. Twin Pipe Graduated Release Air Brake System:

In twin pipe graduated release air brake system, The Brake pipe is charged to 5 kg/cm2 by the driver's brake valve. The auxiliary reservoir is charged by the feed pipe at 6 kg/cm2 through check valve and choke. The brake cylinder is connected to the atmosphere through a hole in the D.V. when brakes are under fully released condition. To apply brakes, the driver moves automatic brake valve handle either in steps for a graduated application or in one stroke to the extreme position for emergency application. By this movement the brake pipe pressure is reduced and the pressure differenced is sensed by the D.V. against the reference pressure locked in the control reservoir. Air from the auxiliary reservoir enters the brake cylinder and the brakes are applied. At the time of release the air in the brake cylinder is vented progressively depending upon the increase in the brake pipe pressure. When the brake pipe pressure reaches 4.8 kg/cm2 the brake cylinder is completely exhausted and brakes are fully released.

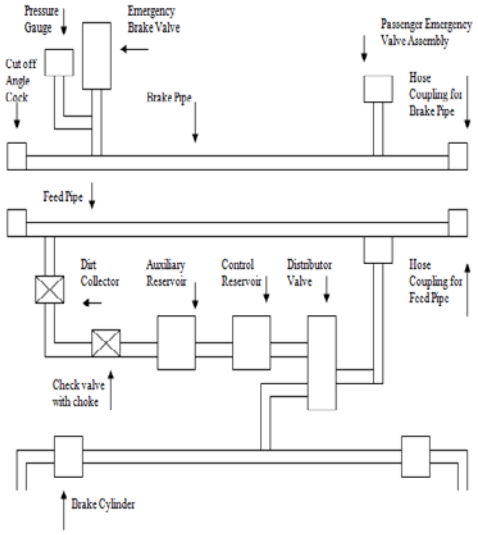

Fig.4 Twin pipe ReleaseAir Brake System

Advantages of Air Brake over Vacuum Brake:

The air brake is preferred in rail vehicles over vacuum brake due to the reasons listed in Table 1.

Tab: 1 Advantage of air brake over vacuum brake

S.N.	Parameters	Air Brakes	Vacuum Brakes
1.	Emergency braking distance (level track, 65 km/hr speed)	632 m	1097 m
2.	Brake power fading	No fading	At least by 20%
3.	Weight of Equipments per wagon	275 kg (Approx)	700 kg (Approx)
4.	Pressure Gradient	No appreciable difference in air pressure between locomotive and brake van upto 2000 m.	Steep reduction in vacuum in trains longer than 600 m.
5.	Preparation time in yards	Less than 40 minutes	Upto 4 Hrs
6.	Safety on down gradients	Very safe	Need additional precautions
7.	Overall reliability	Very good	Satisfactory

HAND BRAKE INDICATION DIAGRAM

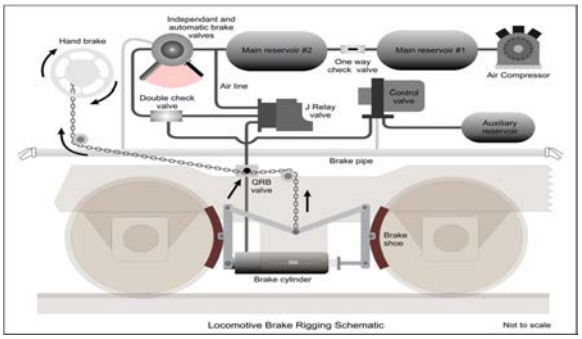

Fig.5 Hand Brake Linkage-Existing

This method requires manual operation in which the hand brake is operated by rotating the steering wheel which is connected to the brake cylinder. The brake cylinder receives pressure from QRB valve from the main cylinder. An indication light is provided to ensure the whether the brake is applied or not.

PROPOSED AUTOMATIC PRESSURE BRAKING DIAGRAM

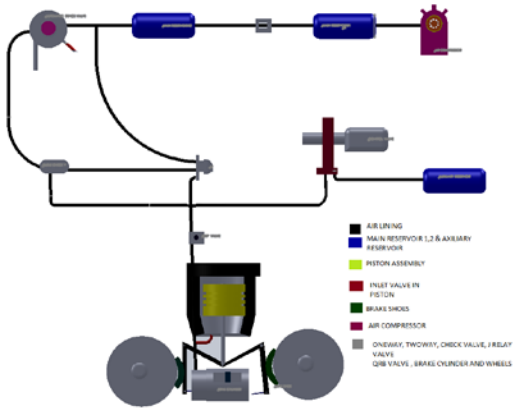

Fig.6

Proposed Automatic Braking System

RESULT AND DISCUSSIONS

Our motto is to convert the hand brake into automatic brake. To make it possible we have introduced a piston assembly near the brake cylinder. As the pressure from the engine is propagates to each coach by the pressure hose. When the pressure reaches the brake cylinder due pressure it push the piston upwards. When there is no pressure after removing the engine from the coach the piston automatically comes down due to the gravity. The upward and downward movement of the piston plays a major role in engaging and disengaging of the brake. When the engine is removed from the connected coaches or the engine is connected to the coaches. When the engine is removed the pressure in the cylinder becomes empty. Hence the piston comes down and engage the brake. When the engine is connected the pressure comes in contact with the brake cylinder by the main reservoir and pushes the piston upwards. Hence the hand brake is converted in to automatic brake.The time required for the manual operation is eliminated. The special attention required to see whether the hand brake is applied or not to avoid the damaging of wheels is eliminated. Hence the automatic brake is very useful for the railways to run is successfully.

CONCLUSION:

The existing hand brake consists of only indicating system with manual operation in this an indication light is used to ensure that the brake is applied or not. But if there is any electrical fluctuation the result shown by the indication light was not equal to the required result.

In the proposed diagram we make the braking system manual to automatic. To make it possible we arranged a piston assembly near the brake cylinder. Hence the braked automatically operated.

REFERENCES

[1] S. Teimourimanesh, T. Vernersson, R. Lunden, F. Blennow, M.Meinel, “Tread braking of railway wheels - temperatures generated by a metro train”, Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, vol. 228, issue 2, 2014, pp. 210-221.

[2] S. Teimourimanesh, T. Vernersson, R. Lunden, “Modelling of temperatures during railway tread braking: Influence of contact conditions and rail cooling effect”, Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, vol. 228, issue 1, 2014, pp. 93-109.

[3] R.C. Sharma, “Recent advances in railway vehicle dynamics”, Int. J.Vehicle Structures & Systems, vol. 4, issue 2, 2012, pp. 52-63.

[4] R.C. Sharma, “Ride analysis of an Indian railway coach using Lagrangian dynamics”, Int. J. Vehicle Structures & Systems, vol. 3, issue 4, 2011, pp. 219-224.

[5] S.Azahu raja, P.Maluventhan, A.Karneswaran, N.M.Mohankuma “Indication Light For Hand Brake On Position In GSLR”

[6] Izumi hasegawa, Seigo uchida, “Braking Systems”.

[7] Yonghua zhu, Weilie Shang, “Research on Braking Porcess of High-Speed Train with Aerodynamic Brake”.