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Implementation of vacuum braking system in four wheeler

V.S. Shaisundaram, S. Karthick *, L. Karikalan

Department of Automobile Engineering, Vels Institute of Science Technology and Advanced Studies, Chennai, India

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ABSTRACT

In railway locomotives, vacuum brakes is using as an alternative of air brake. The vacuum pump, brake pipe is using to make vacuum. The integral arrangement of brake cylinders uses the vacuum tank to applications of the brake. Currently a lot of light duty vehicle are built with the vacuum assist the hydraulic brake system. The vacuum brake system is used to analysis the functioning in both light and heavy vehicle. The vacuum was formed from the engine and use to building the application of the brake. The systems operation are alike an air brake system. In the vacuum brake systems, the vacuum was used before compressed air which used in the air braking system. The design and modified systems include vacuum braking system.

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1. Introduction

The running train contain kinetic energy need to separate the train from running to stopping. The good way of doing this to change energy into heat. The change of kinetic energy into heat typically did by contact materials in between rotating wheels/discs which attached to axle. The materials are adding make friction and convert kinetic energy into heat. The speed is reducing and train is stop. Hence braking material is use as pad/block. The braking system consists of compressed air which transmitting train through the brake pipe. Different level of the air pressure in pipe cause alters in magnitude of the brake. The working of brake equipments on each vehicles depend on circumstance of the vacuum created in pipe by the ejector. The ejector is use steam on the steam locomotives or exhausted by the electric power on the other type of train and remove the pressures from brake pipe for make vacuum. During full vacuum in brake pipe, the brake is release and when the no vacuum, during that time the brake is fully applied. In brake pipe, vacuum is create and maintain by the help of motor driven by exhauster. The exhausters having two type of speed, high low speed. At high speed is switched in to make the vacuum and therefore release by brake. During low speed is use to stay vacuum at necessary level to uphold brake release. It maintain vacuum to prevent the leak in brake pipe. The momentum of moving body rises with weight and speed of body as these factor raise improvement in brake. The wheel adhesion and speed of train are major factor that find total retarding power. The highest retarding force functional by brake block at wheel depends on coefficient of friction between rail and wheel and also component of the weight wheels. The coefficient of friction become equal to unity, then retarding forces will equal to weight of wagon and deceleration equal to gravity. The high efficient brake gives a more deceleration might injure the passengers due to unexpected stopping of the train. Furthermore it causes the brake shoe to wear quickly and lead to risk. The braking efficiency normally from 55% to 85%, which allow the train to stop safely within a rational distances.

2. Vacuum braking system parts

2.1. Valve brake

It is use to control and monitor the brake. It having release, lap, running and brake on. It be neutral or shut down position, which lock the valve out of use. During release position, exhauster joints to break pipe and switch exhauster to the full speed. It cause rise in vacuum in the brake pipe as fastly as likely to get release.

2.2. Cylinder brake

The vehicle has minimum one cylinder but on occasion two or three cylinders. The inside cylinder, piston move to operate brake

* Corresponding author.
E-mail address: skarthickcgm@gmail.com (S. Karthick).

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through links. The links are called rigging apply the block to the wheels. The piston in brake cylinder move with esteem to vacuum in the brake pipe. The loss of vacuum apply the brake, where the restoration of vacuum release in brakes.

2.3. Brake block

It is the friction material which pressed adjacent to piston of the brake cylinder. The brake block made by cast iron. The brake block is main sources of wear in braking system. This brake block needs usual inspection to check work efficiently or not.

3. Brake rigging

It is the system in which piston movement in the brake cylinder transmit the pressure to break block on each wheel. The rigging can hardly ever complex, usually under the passenger car with two blocks to each wheel. The cautious adjustments need by the rigging to make sure that the blocks should operate from the same cylinder which provide even rate of applications on the each wheel.

3.1. Exhauster

The two speed rotary machines fit to the train to reduce the pressures from brake pipe, reservoir and break cylinder to liberate the brake. It is regularly embarrassed from brake valve, in which switched at full speed brake is releases/slow speed to uphold the vacuum at its release the level while the train is running. The exhauster can run honestly from the C.I engine.

3.2. Brake pipe

The vacuum delivery pipe transmits the pressure difference requisite to control brake all through it's the length. By flexible hose the brake pipe associated between vehicles, which can be uncoupled to permit the vehicle to be unconnected. The use of vacuum system makes brake safety and prevent from the failing of brakes.

3.3. Dummy coupling

It is providing the end of each vehicle to permit the end of brake pipe hose to be seal when vehicle is uncouple. The sealed dummy coupling help to avoid from lost of the brake pipe.

4. Conclusion

- The vacuum brake has tremendously limited application due to longer to functions and inappropriate to high speeds.
- Air brake is well-organized as compare to vacuum brake. Though it requires substantial stopping distance. Hence not suitable to emergency braking.
- The mechanical brake must keep in reserve in parallel with another breaking techniques should be use to totally stop the engine at lower speed.
- The requisite braking force can obtain in wide ranges, with regeneration braking use in high speed ranges.
- The electro dynamic brake system intermittently malfunctions due to have compound circuits. So it cannot be use as emergency brake.
- The electro - magnetic break in high speeds are competent methods to the breaking.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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