Train brakes report essay sample

The purpose of this report is to explain how air brakes in trains work and why they are there. Throughout this report there is information on the function of the Air Brake, the history and development of the brake, The component materials used in the brake, the environmental considerations of the brake, its safety features and social implications. The Air Brake was invented in 1869 by a man named George Westinghouse. It was originally designed for trains but Westinghouse then went on to develop the brake for trucks and some cars. The air brake is designed to be used as a failsafe in case the primary brakes fail, however it can also be used in extreme conditions to control the vehicle e. g. very steep hills. The air brake is a relatively simple yet effective system which is still in use to this day.

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Introduction

This report focuses on How Train Air Brakes work, the materials they are made from and the history of Air Brakes in Trains Train Air Brakes basically work on the principal of air pressure. The train driver pulls a lever which activates a pipe of air usually from 65-90psi. This pipe of air runs along all of the carriages of the train. When applied the air simultaneously starts to pump the brake cylinder which activates the brake blocks, effectively stopping the train. The author’s method of approach is to determine how the breaking system works by researching the Breaking System and outlining its function and history. The scope of this report is limited to a Year 11 High School Student. The materials used in this braking system include: Cast iron (brake shoe), Stainless Steel (pipes which contain high pressured air), High Carbon Steel/stainless steel (wheel).

Main Sections

Historical Development

The Air Brake was invented in 1869 by George Westinghouse. Before Westinghouse invented the air brake there were people on each carriage of the train called brakemen. When someone blew a whistle all of the brakemen

would simultaneously apply their own brake or each carriage. There was an earlier model of air brake called the direct air brake, but Westinghouse made the most important discovery of an invention called the triple valve. This triple valve and an auxiliary reservoir made the braking much more responsive and safe.

Innovation Function

The theory behind Train Air Braking systems is that they will stop a train faster and more efficiently than any other method. Basically when the driver of the train wants to stop he activates the brake valve. This brake valve activates the main reservoir which fills the Brake pipe with air, usually between 65-90psi. This pressured air then gets pumped into the triple valve which evenly distributes the flow of air to the brake cylinder which activates the brake blocks and effectively stops the train. The diagram below summarises the basic principle of an air brake.

Figure 1 – A modern day air brake exploded diagram. Image taken from: http://www. railway-technical. com/air-brakes. shtml It is important that the air pressure is distributed evenly throughout the train so that each carriage breaks with the same force. It is the triple valve which is responsible for ensuring that the air pressure is the same throughout the brake pipe. A triple

valve cross section is shown below. Figure 1 – a triple valve system invented by George Westinghouse. Image taken from: http://www. sciencephoto. com/image/438296/530wm/C0115872-Westinghouse_Quick-action_triple_valve-SPL. jpg

Component Materials

The materials used in this braking system include: Cast iron (brake shoe), Stainless Steel (pipes which contain high pressured air) and (Brake Cylinder), High Carbon Steel (wheel), Semi-metals (Brake Pad).

The materials used in the braking system are all suited to their purpose within the braking system as they have the properties require for each part. The braking shoe is made from cast iron because it is very hard and durable. This makes it effective as a braking shoe. The air pipes are made from stainless steel. Stainless steel is a good overall material and it is durable and is able to withstand the pressure of the air while still being cheap. Its advantage is that it won’t rust. Stainless steel is also used in the brake cylinders for these similar reasons. The wheels are made of high carbon steel/stainless steel so they are durable and hard.

The brake block is made out of a semi metal (it varies depending on trains) this is used because it is effective in converting kinetic energy into heat energy. One reason that air is used instead of a hydraulic fluid is that when the trains carriages have to be decoupled the hydraulic fluid would have to be emptied out of the brake pipe. But by using air instead of hydraulic fluid, you can decouple the train without having to empty the brake pipe every time you want to change carriages. There are other alternative materials for

the system such as brass, rubber and ceramics. But the most commonly ones used are as shown above this is also due do environmental considerations. Environmental Considerations

An environmental consideration installed on trains is regenerative braking. Regenerative breaking means that rather than the engine of the train being stopped while the train is breaking it stays on and puts power back into the grid system of trains. This means that trains use less electricity.

Social Implications

Air brakes are very good as they create little to no noise when braking. This is a good social implication as it means that railways can now be built closer to homes without noise complaints. It also means that trains become more appealing to be on as people can talk without having to yell over the sound of the train. These factors make public transport more appealing to the public which could result in more people catching trains than driving to work to help the environment. Future Considerations

There are no future considerations for Air Brakes on trains because new trains such as the magnetic train don’t need Air Brakes to operate. So there is no need to upgrade the braking system, rather just upgrade the whole network of trains. However if trains were to increase in size there is talk of using stronger materials than cast iron in the brake blocks. Another idea is to Coat the cast iron with another material that will create more friction between the wheels and the brake block, such as Teflon fibres.

Safety Considerations

The air brake is a relatively fail safe system where not much can go wrong

but there are methods in place to protect the train if something fails. This includes a release valve in case the air pressure builds up too much in one part of the train. The air brake can also be used as a safety consideration in case the driver needs to brake hard. The brake block can lock on the wheels which will make the train skid to a halt. This is only used in emergency situations though.

Conclusion

The Air Brake has existed for more than a century and yet there has been little modification and no better system to brake electric trains invented to this day. This system of braking has been quite effective in its safety features as it has saved lives. All of the materials used in the manufacturing process for train brakes are used because of their specific properties. Each of these materials helps the brake to perform its intended function. This system of braking has proven to be effective in the past and the present and still will be in the future.

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