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Research Paper

TRANSITION FROM LARGER FIBA TO COMPACT FIBA

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There are different types of coaches which are used in Indian Railways. Some of the Coaches are used for carrying passengers over long distances. In order to have smooth journey these coaches are fitted with Air Spring Bellows which absorbs the shocks and jerks which are created due to undulation of track and many other reasons. Since Air spring bellows are filled with compressed air some mechanism is required to detect and apply the brakes in the train in case of any such failure. There are many such designs of FIBA which detects the Failure of Air Spring and apply the Brakes. Most of these designs involve a large number of parts and are comparatively bulkier in size. These reasons have made it a very expensive device. In order to make it more affordable there is need of doing further research on it so that it can be made economical with out compromising on its functionality and can be used on all kind of passenger trains. This research paper is an attempt in this direction.

Keywords: Air spring, Bellows, Brake application, FIBA

INTRODUCTION

Air Spring suspension used in coaches work on 4 point control system. It involves 4 Leveling valves and 2 Duplex Check Valves. As the load varies in coach, Air Springs reacts by either by allowing the compressed air pressure to the Air Spring or by releasing air from it to atmosphere.

Thus unlike Steel spring maintains their height under the influence of varying load. Air Springs in coach offer a load proportionate stiffness, constant floor height and better ride behavior at high speeds.

Although Air Spring is very useful in coaches but there is always a need of development of a cost-effective system which can immediately communicate to driver about the deflation of any air spring for enabling the Driver to take further action. Followings are the standard nomenclatures used in this paper:

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FIBA – Failure indication cum brake application

BP – Brake Pipe

FP – Feed Pipe

AS – Air Spring

DCV – Duplex Check Valve

LV – Leveling valve

IC – Isolating Cock

NRV – Non return Valve

CV – Check Valve

NB – Nominal Bore

ICv – Isolating cock with Vent feature

RDSO – Research Designs & Standards Organization

Objective of Research: This paper has the intention to present one concept on Air Spring Failure indication cum Brake Application system which is quite cost effective and fulfills the requirement of a fool proof arrangement in the suspension design which will send the communication to the Driver in case of Air Spring Failure. In turn Driver will reduce the speed of the train to avoid any emergency situation afterwards.

Basic Principle: The research to be conducted is based on the basic principle that in the event of air Spring failure the system should actuate the application of brake. This will immediately reduce the speed of the train and will ultimately cause the train to stop.

Scope of Research: This research paper will focus on development of a fail-safe system which can immediately and automatically reduce the speed of train by applying the brake and stop within a reasonably safe distance in the event of the air spring getting deflated due to any reason. The research will also ensure that the Driver of the train gets a positive indication for identifying the failed air spring in the train formation. Research will be extended to the extent that a mean is provided on the train to run at a restricted speed so that it can reach to the desired destination.

Limitations of Research: The only major limitation is that the existing Air Spring Failure Indication cum Brake Application Devices will be used as a reference and a new concept will be derived to make it a more economical, easy to manufacture and easy to install design. Since it is not possible to validate this concept on a train (as it involves lot of approvals from Railway Authorities) it shall be validated on test equipment which will simulate the coach.

SUMMARY

This chapter presented the objectives and scope of this research that is development of an economical version of FIBA. It presented some background information of the FIBA, the purpose of fitting it on a coach and established a point of departure for this research. As a result, recommendations will be made on how to design a cost effective version of FIBA without compromising in any of the given objectives. Test results will also be presented to support the validation of this design.

REVIEW OF LITERATURE

The Carriage Directorate of Research Designs and Standards Organization (Ministry of Indian Railways) has made some technical notes for the developmental purposes of Air Spring Failure Indication Cum Brake

Application system for Pneumatic Suspension Bogies used over Indian Railways. This technical note has laid down the technical requirement of the FIBA Device. It has also described the three recommended working principles of FIBA device. These are as follows:

Pressure Differential System: System consists of a valve to sense the pressure of compressed air in each bellow of the bogie constantly and initiate normal brake application when the difference in pressure between the bellows in that bogie becomes more than 1.7 (+0.15, –0.05) Kg/Sq. cm. FIBA should apply brake in the complete train and should provide whistling sound as well as red indication through indicator provided with FIBA device.

Absolute Pressure System: System consists of a valve to sense the pressure of compressed air in each bellow of the bogie constantly and initiate normal brake application when the pressure in any or both air spring bellows of concerned bogie drops to 1 ± 0.1 Kg/Sq. cm. FIBA should apply brake in the complete train and should provide whistling sound as well as red indication through indicator provided with FIBA device.

Dual System: System follows both Pressure Differential System as well as Absolute Pressure system. In loaded condition it follows Pressure differential System whereas in tare condition it follows Absolute Pressure System. The System consists of valves to sense the pressure of compressed air in each bellow of the bogie constantly as well as differential pressure between both bellows of concerned bogie. Normal Brake application is initiated whenever pressure in any or both air spring bellows of concerned bogie drops to 1 ± 0.1 Kg/Sq. cm. OR whenever the pressure difference between both air spring bellows become more than 1.7 (+0.15, –0.05) Kg/Sq. cm. due to bellow burst or spring failure. FIBA should apply brake in the complete train and should provide whistling sound as well as red indication through indicator provided with FIBA device.

There are 26 technical requirements for all above three systems and a FIBA device has to meet all these technical requirements.

Existing FIBA Device: The Figure 1 shows the schematic diagram of existing FIBA which is used on Indian Coaches. Generally it consists of 16 devices and one Manifold over which all these devices are mounted. Figure 2 and Figure 3 shows the photo of actual product.

The Manifold Plate which is made of a corrosion resistant material (Aluminium) has the overall dimensions of 320 × 230 × 32 mm and it weighs 5.83 Kg. Similarly the protection cover which is also made of a corrosion resistant material (SS-AISI 304) is quite larger in size to accommodate all the 17 devices/ parts.

A Manifold consists of a plate and it has several holes. The diameter of the drill is dependent on the air flow requirement of the devices. All the devices are directly mounted on the Plate and hence called as panel mounted type devices. O Rings or Sealing rings are used to avoid any leakage from the interface. The mounting dimension of the Bracket is controlled by the Indian Railways specifications.

New FIBA Device: The same functionality as of existing FIBA device can be achieved by following the Pneumatic Schematic diagram as shown in Figure 4.

Figure 1: Pneumatic Schematic Diagram of Coach

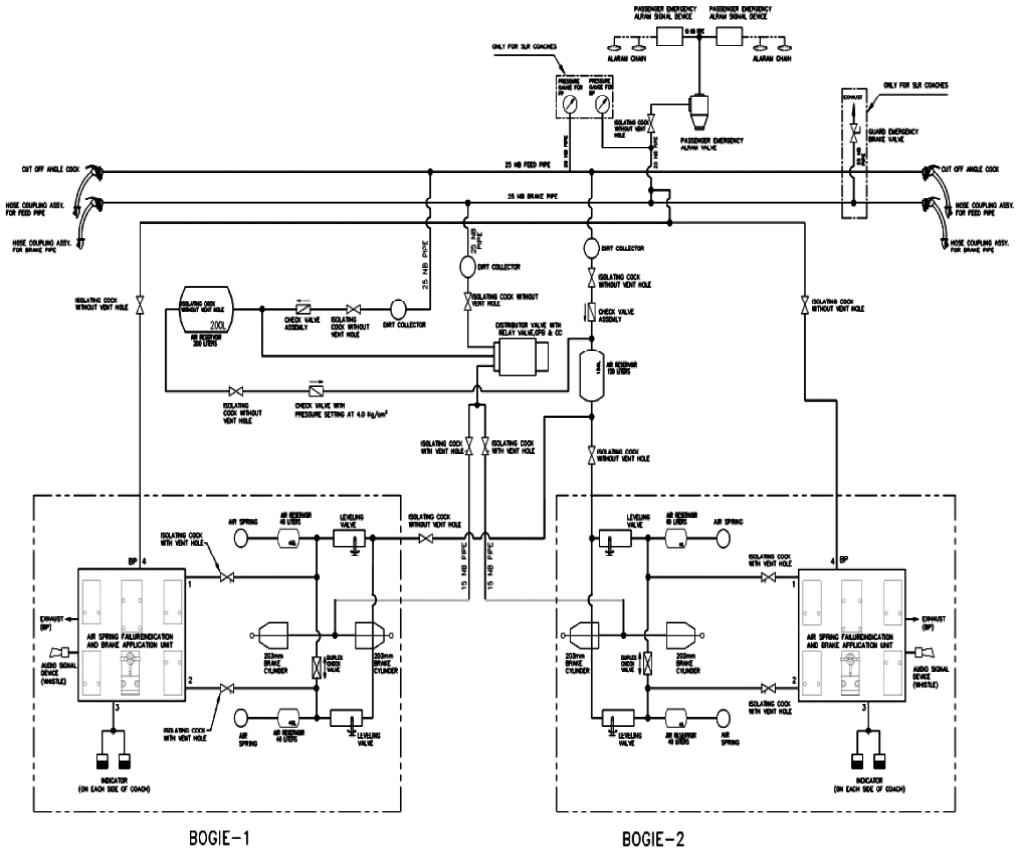


Figure 2: Actual Picture of FIBA Device

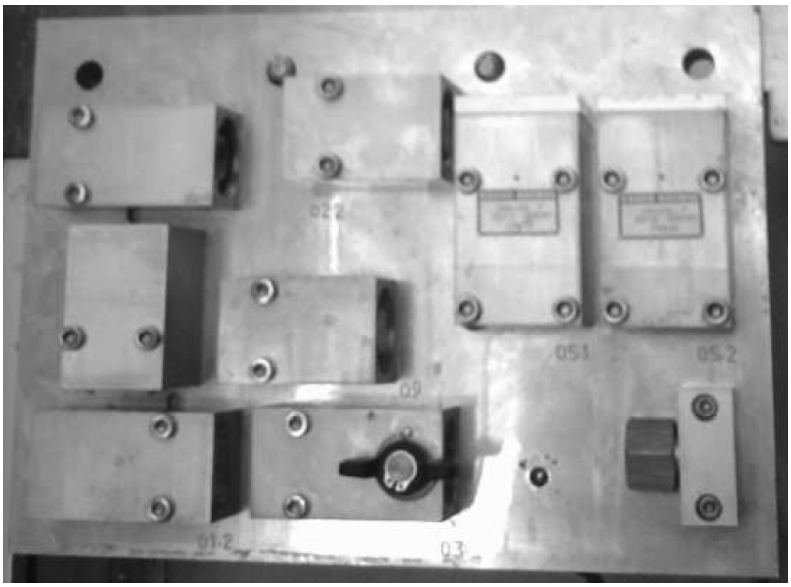
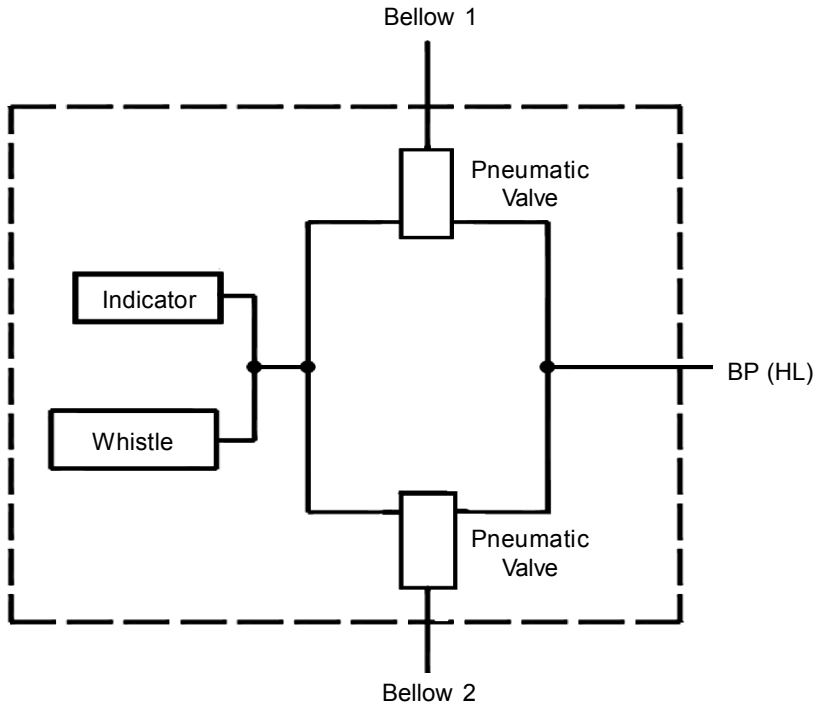


Figure 3: Snap Shot of 3D Model of FIBA Device

Figure 4: Pneumatic Schematic Diagram of New FIBA



The number of devices has been reduced to 07 nos. As can be seen from the Figure 5 the overall dimensions of the Manifold which is made of Aluminum are now reduced to 200 × 145 × 30 mm and it weighs only 2.12 Kg. Similarly the protection cover which is made of SS (AISI-304) has also reduced according to new Manifold.

Figure 5: Snap Shot of 3D Model of New FIBA Device

CONCLUSION

The test results of one prototype which was made as a part of this research shows that this concept of new FIBA can be introduced in coaches after getting the necessary approval from Indian Railways. Since this new FIBA will provide many advantages over the existing FIBA it is recommended to make the commercial use of this idea. Few of the advantages of New FIBA are:

- Economical.
- Lighter in weight.
- Easy to handle.
- Compact in size.
- Involves less no. of parts thus requires less maintenance.
- More reliable due to less no. of parts.

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