

PAPER • OPEN ACCESS

Research on Automatic Drainage System Technology of Vehicle Gas Storage Cylinder

To cite this article: Xiaohu Yang *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **267** 042179

View the [article online](#) for updates and enhancements.

Research on Automatic Drainage System Technology of Vehicle Gas Storage Cylinder

Xiaohu Yang^{1, a}, Ting Zhang^{2, b}, Shimiao Zhang^{3, c}

¹Ruili Group Ruian Auto Parts CO. , LTD. , Wenzhou 325200, China

²Ruili Group Ruian Auto Parts CO. , LTD. , Wenzhou 325200, China

³Ruili Group Ruian Auto Parts CO. , LTD. , Wenzhou 325200, China

^asorlyxh@163. com, ^b495996546@qq. com, ^c410998513@qq. com,

Abstract: In view of the technical problems in the existing technology of the air storage cylinder drainage device in the vehicle braking system, this invention provides an automatic water drainage system for the whole vehicle. An ECU controller is used in this system to control the electromagnetic water drainage valve and sensors to realize intelligent water drainage.

1. Introduction

In the braking system, the function of air storage cylinder is to store compressed air for braking or other use. The air storage cylinder is usually a part of the brake system. The air inside the cylinder is compressed by the air compressor and filtered through the dryer. After the user steps on the foot brake pedal, the high-pressure gas in the air brake pipeline pushes the air chamber push rod out, causing the brake pliers to move and squeeze the friction brake disc for the purpose of braking.

When air is being compressed, the components of water and oil in compressed air do great harm to the working system. It is necessary to release the water and oil in the system in time and effectively. As a key energy storage element in gas pipeline system, gas storage tank has the largest water content, and its discharge requirements are more stringent. The gas storage tank needs to adopt automatic discharge technology to achieve high-precision control.

2. Current status of automatic drainage technology for gas storage tanks

2.1. The technical scheme of installing an automatic drain valve on the gas storage cylinder.

For example, an automatic drain valve for automobile air brake system, which is disclosed as CN202469164U patent of China utility model, is provided with an intake chamber at the top of the valve body connected with the automobile gas storage cylinder. A valve chamber is in the valve body and a valve seat is fixed at the bottom of the valve chamber. There is a piston in the valve chamber and a piston rod on the piston. A water discharge chamber is provided in a valve seat with air holes between the intake chamber and the valve chamber. In addition, a solenoid valve with electromagnetic stem is provided. There is a stem chamber on the valve body and a push air chamber on the top of the valve chamber. There is an air outlet between the intake chamber and the stem chamber. An air intake passage is provided between the air chamber and the valve stem chamber. The front part of the electromagnetic valve stem chamber is inserted into the valve stem cavity. The inner wall of the water

discharge chamber is provided with a valve seat water drain tank. The piston rod is provided with a piston water drain tank. The structure valve has fast speed of water discharge and convenient installation. The working principle of installing an automatic drain valve on the gas storage cylinder is that when the air pressure in the gas storage cylinder decreases and the difference meets the requirements of the automatic drain valve, the automatic drain valve will work to remove a little gas and bring water out of the gas storage cylinder. There are two main problems in this scheme: a. As long as the air pressure of the gas storage tank decreases and the difference meets the requirements of the discharge valve, the discharge valve will work and exhaust. It does not care about whether there is water in the gas storage tank or not, which will cause unnecessary waste of gas sources. b. When different air compressors work, the contents of water and oil are different. If the times of the discharge valves working and the discharge quantity are insufficient, the water will be accumulated in the storage tank.

2.2. Technical scheme of solenoid valve controlling drain valve.

For example, the Chinese utility model patent No. CN203601264U discloses an automatic water discharge control system for vehicle gas storage cylinder, which consists of gas storage cylinder, water discharge valve and solenoid valve. The water discharge valve has a control port connected to the control gas, and the water discharge valve is connected to the gas storage cylinder. The solenoid valve is connected to the pipeline of the control gas. When the ignition of the vehicle is turned on, the power of the solenoid valve will gain and vice versa. It automatically controls the opening or closing of the solenoid valve. When the solenoid valve is in operation, the control gas is connected to the control port of the discharge valve to open the discharge valve to release water from the storage tank. When the solenoid valve is cut off, the control gas is cut off and cannot be connected to the control port of the discharge valve to close the discharge valve to stop discharging water. The solenoid valve is used to control the discharge valve, and the driver controls the discharge valve by switching the button to turn on or off. If the driver is not familiar with the drainage function or forgets to operate the switch button, it will result in the delay of the drainage of the gas storage tank and water accumulation of the gas storage tank.

3. Technical Scheme of Automatic Drainage System

Aiming at the problems in the existing technology of the air cylinder drainage device in the vehicle braking system, an automatic water drainage system for the whole vehicle is put forward. The automatic waterproof system of the whole vehicle adopts ECU controller. According to the actual number of air cylinders in the whole vehicle, electromagnetic water drainage valves and sensors are installed under each air cylinder. The sensors are used for monitoring the air pressure and water accumulation in the cylinder timely. The electromagnetic drain valve is used to discharge water. The ECU controller controls all sensors and electromagnetic drain valves as a whole, and realizes the intelligent drainage of the cylinder in the vehicle braking system.

The vehicle automatic water discharge system includes an air compressor installed in the vehicle braking system, a dryer connected with the air compressor and a plurality of air storage cylinders connected with the dryer. One end of each air storage cylinder is connected with a dryer, and the other end of each air storage cylinder is connected with a vehicle air unit. The vehicle automatic drainage system also includes an ECU controller. At least one sensor and one solenoid drainage valve are installed under each gas storage tank. Multiple sensors and solenoid drainage valves are connected to the ECU controller through data harness respectively.

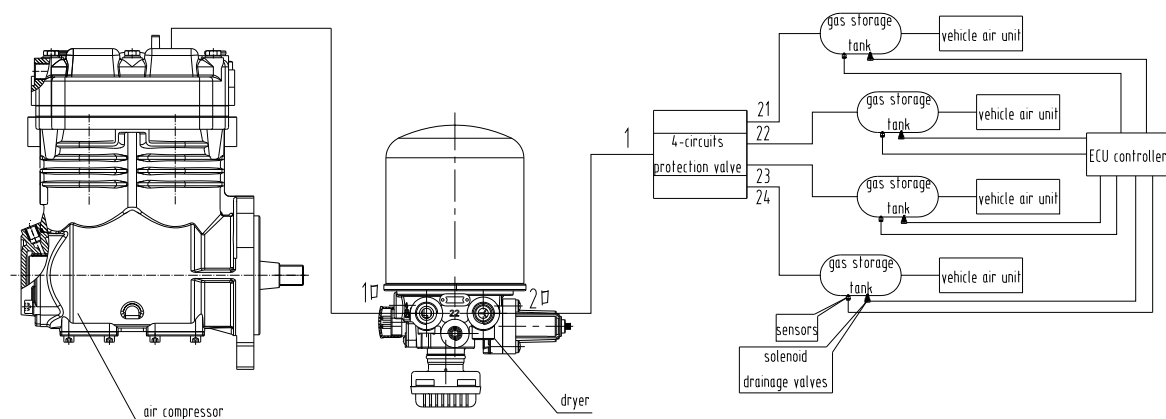


Fig. 1 Auto-drainage system diagram of the whole vehicle

4. Working Principle of Automatic Drainage System

In the automatic water drainage system of the vehicle, sensors and electromagnetic water drain valves are installed under each gas storage cylinder. Each sensor monitors the air pressure and water accumulation inside the gas storage tank timely. Converts the detected data into an electronic signal and transmits the electronic signal to the ECU controller through the data harness. The ECU controller controls the electromagnetic discharge valve conditionally by receiving the electronic signal and according to the program set. If the air pressure of the whole vehicle is greater than 8 bars and the sensor detects the water accumulation in the storage cylinder, the ECU controller controls the electromagnetic drain valve to discharge air. If the air pressure is less than 6.5 bars or there is no water accumulation in the storage cylinder, the ECU controller will not control the electromagnetic drain valve. The internal parameters can be re-calibrated according to the actual operation of the vehicle.

4.1. The ECU controller controls each solenoid discharge valve independently.

According to the feedback information from the corresponding sensors, the ECU can communicate with the solenoid discharge valve to make it work. If the sensor collects no water in the gas storage tank, the ECU controller will not control the electromagnetic water discharge to work, so as to avoid the waste of air source. If there is too much water, it will make the electromagnetic discharge valve work longer. Intelligent drainage is realized.

4.2. A "safe air pressure" will be set in the ECU controller, which is currently designed to ensure that the vehicle has sufficient air pressure when braking.

When the solenoid discharge valve is working, the air pressure in the gas storage tank will decrease. Only when the air pressure in the gas storage tank meets the "safe air pressure" standard and there is water in the gas storage tank, can the ECU controller control the electromagnetic discharge valve.

5. Conclusion:

The intelligent drainage of the air storage cylinder in the vehicle braking system is realized by using ECU controller. According to the actual number of gas storage cylinders in the vehicle, electromagnetic drain valves and sensors can be installed under each gas storage cylinder. Sensors are used to monitor the air pressure and water accumulation in the gas storage cylinder timely. Electromagnetic drain valves are used to discharge water. ECU controller controls all sensors and electromagnetic drain valves as a whole to realize intelligent drainage.

Reference:

- [1] *Study on the Capacity Characteristics of Energy Storage Device of Pneumatic Braking System* [J].Huang Chaosheng, Liu Minghui, Hou Guozheng. Automotive Engineering. 2004 (06)

- [2] GB 12676-2014. *Structure, performance and test method of automobile brake system* [S].
- [3] *Structural optimization design and analysis of gas storage cylinders for automobiles* [J]. Songjiang, Zhang Lijun, Zhao Yongrui. Electromechanical Engineering Technology. 2013 (06)
- [4] *Calculation and Selection of the Volume of Air Storage Cylinder of Bus Chassis Brake System* [J]. Zhang Wei, Hao Haisheng, Wang Ling. Bus Technology and Research. 2012 (02)
- [5] *Analysis of burst failure of loader gas storage tank* [J]. Li Hongzhong, Liu Haifeng. Construction machinery. 2004
- [6] *Automatic Drainage Control System for Vehicle Gas Storage Cylinder*. Hu Guoqing, Luo Zhongqun. Guo Kun Patent No. CN203601264U, 2013-11-28
- [7] *An automobile brake electromagnetic automatic drain valve*. Zhang Jianguo. 2012-03-13 Patent No. CN202469164U