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Trailer valve study with adjustable choke function based on the prior volume

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Abstract: With the continuous development of China's market economy, the demand for commercial vehicles is increasing, and the loading capacity of traditional tractors in the transportation sector cannot meet the demand. As the problem of carrying capacity has been solved by the advent of trailers, the reliability and environmental protection of the products are more and more concerned and studied by the automobile developers. This study describes the structural design principle of the trailer brake control system and analyzes the key component – trailer braking valve through the connections and output line with hand brake valve and foot brake valve and the product performance and environmental protection.

1. Introduction

In recent years, China's economy has achieved rapid development. Commercial vehicles have played an important role in the development of economy in the transportation industry, and the demand for commercial vehicles has been increasing. In order to meet the need of carrying capacity, the trailers are appeared. The trailer braking control system is the key system of the trailer, and the performance is related to the performance of the vehicle directly. As one of the most critical parts of the system, the quality of the trailer valve can affect the performance of the trailer brake control system directly.

2. Trailer brake control system

Figure 1 is the structure schematic diagram of the trailer brake control system, which consists of the air supply system (A), the control system (B) and the trailer execution system (C). The trailer brake control system consists of hand brake valve (D), foot brake valve (E) and trailer brake valve (F).

The principle of trailer brake control system is as follows:

The tractor air supply system (A) always maintains the air pressure state to the control system (B). The air from compressor (M) is filtered by the dryer (N), then goes to air tank (G). The air tank(G) keeps the air supplying for the first circuit inlet and the second circuit inlet of foot brake valve(E), the inlet of hand brake valve(D) and the inlet of trailer brake valve(F). The air of the trailer brake valve(F) is connected to the air supply line of the trailer directly, and the air is transferred to the trailer. In the course of driving, the outlet of hand brake valve(D) in the control system(B) transfers the air to the trailer brake valve(F) continuously.

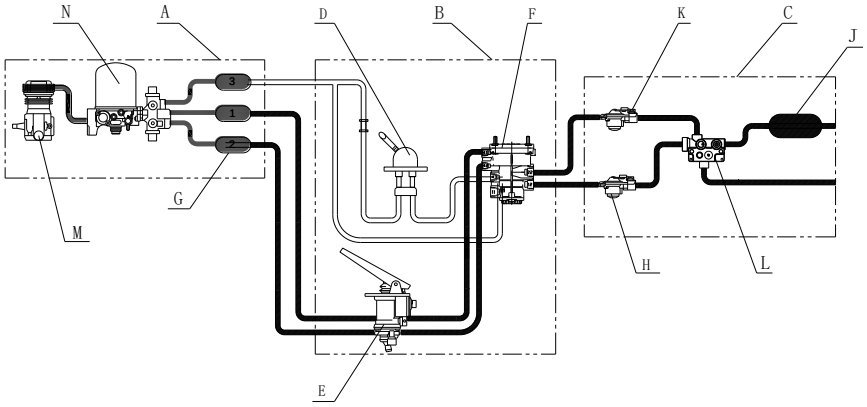
When the driving vehicle needs to carry on the braking, the driver steps on the foot brake valve (E), the outlets of the first circuit and the second circuit of foot brake valve(E) control the control ports of the first circuit and the second circuit of the trailer brake valve(F), so the trailer brake valve can discharge the air to the trailer control pipe(K), and then trailer emergency relay valve(L) in the trailer execution system© works and transfers the air to the braking chamber to realize the driving brake.

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When we need to release the brake, the driver should release the foot braking valve(E) and then the trailer braking valve(F) and trailer emergency relay valve(L) will work and discharge the air in the trailer braking chamber.

When the vehicle is in a state of parking, the driver loosen the hand brake valve(D), the released air controls the foot brake valve(E) and trailer emergency brake valve(L) to transfer the air to the braking chamber to achieve the parking brake.

The trailer brake valve(F) is the core component of the trailer brake system, and its performance affects the normal operation of the trailer braking system directly.

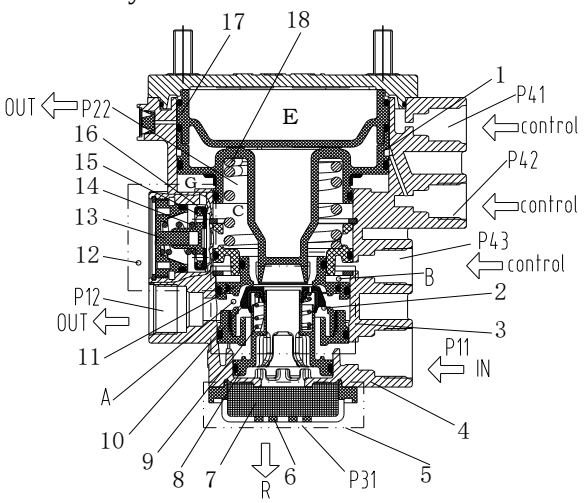


A. air supply system, B. control system, C. trailer execution system, D. hand brake valve, E. foot brake valve, F. trailer brake valve, G. air tank, H. trailer gas supply line, J. trailer holder, K. trailer control piping, L. trailer emergency relay valve, M. air compressor, N. air dryer

FIG. 1 Structure diagram of Trailer brake system

3. Trailer brake valve

The basic composition of the trailer brake valve is shown in figure 2. It is mainly composed of conventional trailers brake valve function throttling system function, adjusting function of priority system function and noise reduction system function.



1.foot valve control port controls piston, 2.orifice, 3.Throttle function part, 4.the valve body, 5.noise reduction section, 6.silencing tower, 7.silencing network, 8.intake piston, 9.spring, 10.the valve, 11.the valve seat, 12.the valve seat, 13.prior regulating seat, 14.spring, 15.prior valve, 16.prior valve port, 17.foot valve # 1 control port controls piston, 18.spring

FIG. 2The structure diagram of the trailer brake valve.

3.1 Conventional trailer brake valve function

No matter the wheel-less vehicle is in moving or stopping condition, the air from the air supply system always acts on the valve 10 and the valve seat 12 through the trailer brake valve inlet P11. During the driving process, the outlet of hand brake valve always transmit the air to the control port P43 of trailer brake valve. The air in P43 passes through area B and acts in valve (10), so the air pressure between Area A and P11 is balanced and the valve (10) does not open. In the meanwhile, the air from P11 goes to P12 through Area A to control the outlet of trailer emergency relay valve, so the trailer tank will discharge the air to the trailer braking chamber.

When the vehicle needs to brake, the driver steps down the foot control valve, and the first outlet air of the foot control valve reaches E cavity by controlling the first loop control port P41 of the trailer control valve. And then the displacement of control piston (17) of the first control port and the control piston (1) of the second control port can be adjusted by the foot brake valve. The first control port of the drive foot valve will control the piston 17 to overcome the force caused by spring 18, spring 9 and then to open the valve 10.

At this point, the pressure of the P11 port reaches the C area to the P22 port through the passage between the valve 10 and the valve seat 11, and the spring 18 acts with the spring 10 on the foot valve second control port to control the piston 1, so that the E chamber and the C chamber air pressure are fast balanced. The P22 port controls the emergency relay valve starting work of the trailer execution system and it conveyes the air pressure to the driving chamber of the brake gas chamber to complete the driving brake. The trailer brake valve is a dual pipeline control system. The second circuit control port P42 of the trailer brake valve acts the same as the first trailer circuit port P41, when the first circuit control port P41 fails. the second circuit control port P42 can still finish braking.

When it is necessary to release the brake, the driver releases the foot brake valve so that the air pressure of the first loop control port P41 is lowered through the foot brake valve vent and emptied. Under the action of spring 18 and spring 9, the valve 10 is reset and the P11 is closed, so the passage between area A and C is cut off. The air in the controling chamber of trailer emergency relay valve is discharged by the exhaust P31 via the output P22 of the trailer braking valve. At this point, the air pressure of the trailer brake air chamber is discharged through the exhaust of the emergency relay valve, and the vehicle brake is relieved.

When the vehicle is in the parking state, the driver loosens the hand brake valve, and the hand brake valve outlet air to control the p43 of the band brake valve of trailer brake valve, so the air in area B will go to P43 and discharge to environment by the exhaust port of hand brake valve. In this moment, the balance between upper chamber B and lower chamber A of valve (11) is broken. The valve (10) and valve seat (12) moves upward under the action of the air in area A and spring (9). The valve (11) contacts with the control piston of the second control port, the valve seat (12) keeps moving and open the passage between area A and C. So the air from P11 can go to the emergency relay valve of trailer execution system through area A, B and P22, then the emergency relay valve works to control the braking chamber to discharge air to the driving chamber to realize the parking brake.

3.2 Throttle system functions

During the driving process of the vehicle, the air from the inlet P11 of the trailer control valve goes to emergency relay valve through P12, and then the emergency relay valve controls the trailer tank to discharge the air to the trailer braking chamber. In the process of vehicle traveling crane brake, if trailer control line split windpipe or blasting, trailer P22 pneumatic brake valve control line output fell sharply, it will lead to the broken of the air pressure balance between the upper and lower chamber of control piston. P41 pressure actuator valve 1 controls piston 17 to push valve 10 down to the limit, valve 10 blocks the air from P11. At this point, the air of the valve inlet P11 can only be passed through the valve 10, and the air of the outlet P12 is sent to the trailer pipeline, and the pressure from P11 to P12 is throttling.

When the air pressure of P12 port drops to the specified pressure value of the system, the trailers can be operated with emergency relay valve, so that the air pressure of the trailers can be transported

through the outlet of the emergency relay valves of the trailers, and the brake air pressure will be transported to the trailers' brake chamber, completing the emergency brake of trailer to ensure the safety of driving.

3.3 Prior system regulating function

In order to solve the phenomenon that the pressure of the trailer output pipeline is lower than the output pressure of the tractor, a prior function is set up. The area of the cavity chamber C acts on the foot valve second control port control piston is smaller than the cavity chamber E air pressure acts on the foot valve first control port control piston. The pressure of the trailers brake valve control pipeline outlet P22 is 20~30 kPa higher than that of the first trailers valve control port P41, and the prior adjustment can be realized.

When the trailers brake valve control pipeline P22 output pressure at the same time, the air pressure will pass through the prior valve port 16 and act on the prior valve 15, and overcome the spring 14 to the left motion. At this time, the prior valve 15 is separated from the prior valve port 16, letting air pressure entered into the G cavity through the prior valve 15 channel, and the foot valve has the second control port to control the piston 1 and the foot valve first control port to control the piston17. C cavity and G cavity act together to achieve pressure balance with E cavity, so that the second control port of foot valve controls piston 1 and the first control port of foot valve control piston 17 is in the balance position, that is, working position.

The force of the spring 14 can be adjusted by the prior adjusting seat 13. The pressure of the trailers brake valve control pipeline outlet P22 is 20 ~ 30 kpa higher than the first trailers valve control port P41, and the prior volume can be adjusted.

3.4 Noise reduction system function

The valve outlet is equipped with a sound absorber 6, and the sound absorber 6 is equipped with a silencing net 7. A mesh filter made of plastic is used to eliminate the sound of sudden gas flow from the cavity. Limitting the exhaust noise generated during the exhaust process to the acceptable range of staff to meet environmental protection requirements.

4. Conclusion

The trailer valve with throttle function of prior regulation is a new product with market oriented, user oriented, developed, designed and completed in a relatively short period of time by SORL. Its development makes the company's product diversification development, which will create good economic benefit for the company.

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