

Design and Application of a Multi-function Combined Hydraulic Oil Cylinder

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Abstract

Hydraulic equipment in engineering, in different working stages, different speed, load, variable load and variable speed is one of the most frequently encountered problems, to solve this problem is usually used to continuously adjustable pressure, adjustable flow control to achieve. In this paper, the structure design of a combination of oil tanks, combined with oil circuit examples in the case of no need to adjust the pressure, adjust the flow rate, to achieve the high speed, light load of the typical operating requirements and hydraulic servo feedback.

Keywords-Variable load; variable speed; structure design; application

I INTRODUCTION

In the practical application of hydraulic engineering machinery, variable load and variable speed is one of the most common load driving situations, it requires the hydraulic cylinder to drive heavy load in some time, but at other times, the driving load is small, and in the case of a big load, speed slow, small load speed soon, in order to improve the work efficiency of equipment. For this application, in the design of hydraulic system, the sectional area of the hydraulic cylinder must be large enough to drive a large load, so when the load hours, to achieve high speed, it is necessary to add the hydraulic oil of the hydraulic cylinder, hydraulic oil pump and the corresponding discharge amount and the power of the motor should be this large waste of energy, plus the sectional area of cylinder, affect the speed of the inevitable decline. To this end, the design of a multi-functional combination of oil tanks, to solve the problem of small load fast movement, large load slow motion.

II DESIGN OF MULTI-FUNCTION COMBINED OIL CYLINDER

Multifunctional composite cylinder structure as shown in Figure 1, is mainly composed of a cylinder, the cylinder rod, the cylinder rod and 4 oil port. The cylinder block and cylinder head cylinder form a sealed volume, the cylinder rod through a combination of two seal is sheathed in the cylinder body, composed of ordinary double acting hydraulic cylinder. The difference is that the cylinder rod inside the 2 seal set by the cylinder rod, the two are composed of a hydraulic cylinder. The combination of cylinder is formed inside the A cavity and the B cavity and C cavity and the D cavity two of the oil chamber, A cavity and the B cavity respectively by A and Boil port, C cavity by C oil port, oil port cavity through the oil pipeline within the cylinder rod inside the D cavity by D oil port through between the inner cylinder rod and the oil pipe the supply channel.

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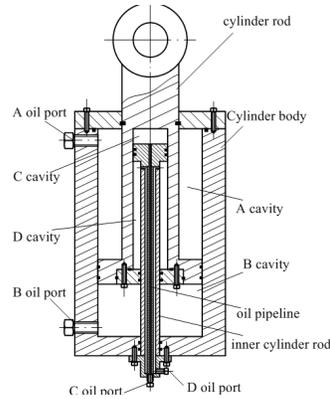


Figure 1. Structure diagram of multi-function combined oil cylinder.

III APPLICATION

A. Double load and double speed

By using the combined oil cylinder, the heavy load and low load speed can be realized. As shown in Figure 2

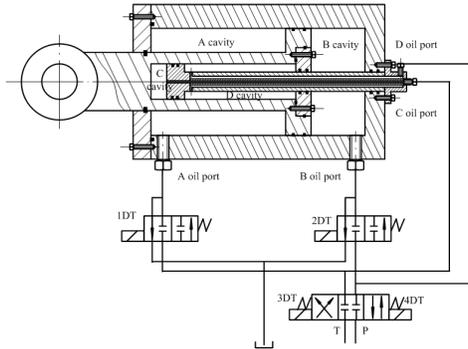


Figure 2. Dual load dual speed function.

A) Light load high speed

1DT and 2DT have no electricity, A cavity and the B cavity is directly connected with the hydraulic oil tank, 3DT electric valve, left station access, high-pressure oil into the oil port, connected by C oil pipeline cylinder rod inside the C cavity, D cavity oil by D cavity by D between the inner rod and the cylinder oil port through the oil pipeline D channel, choke back to the tank cylinder rod, because the area is small, under the same flow conditions, cylinder rod speed, realize the fast light load work. The same 4DT connected to the power, the right side of the spool access, cylinder rod quickly recovered.

B) Heavy load slow

The 1DT is switched on, 2DT is not connected to the power supply, 3DT power, spool left station access, P high pressure oil respectively into the A cavity and the C cavity, the B cavity and the D cavity is connected with the oil tank, so the cylinder rod recovery, because the A cavity and the C cavity area, so under the same flow conditions, the cylinder rod retract speed is slow, but large force, the slow recovery of heavy work. The same 2DT power, 1DT shall not power, 4DT power, the valve core access, P high pressure oil into the B chamber, D cavity, due to the A cavity, C chamber to connect the fuel tank, so the cylinder rod load slowly extended.

B. Servo feedback

In order to realize the control which is related to the position of the cylinder rod of the cylinder, the cylinder has the function of the servo feedback, as shown in figure 3.

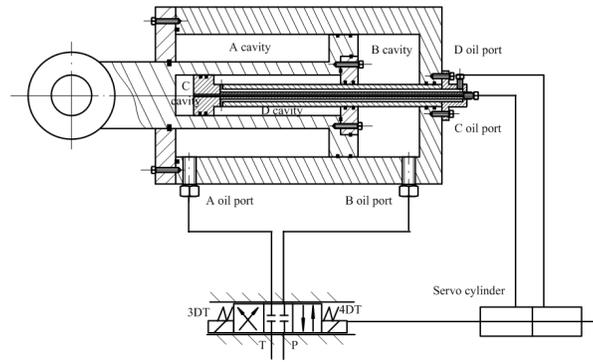


Figure 3. Servo feedback.

The C cavity and the D cavity are respectively connected with the servo cylinder about two cavity connection, when 3DT or 4DT is electrified, the cylinder rod is extended or retracted at the C cavity and the D cavity are oil or oil, drive servo cylinder movement feedback control solenoid valve spool position, then control the extending of the combination cylinder. Is the C cavity and the D cavity position servo cylinder oil import volume, and is proportional to the amount of the telescopic cylinder rod, thus reaction cylinder rod position, thus forming a feedback control loop of hydraulic servo loop.

IV CONCLUSION

Through the structure design of the multifunctional combined oil cylinder, and the application of analysis in the two case, the multifunctional combined oil cylinder piston rod structure by nested small cylinder, typical to solve the heavy load and slow speed and light load by using high speed action area difference work requirements. The method of connecting the two cavity of the small oil cylinder to the servo cylinder, which has the function of the hydraulic servo feedback, realizes the automatic precise control. This oil cylinder has a very wide application prospect in the lathe processing, automobile chassis steering, brake control, engineering machinery and aviation, national defense and so on.

Reference

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