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Rotating Clamping Device of the Hydraulic Prop Disassemble Machine Based on Hydromechanics

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Abstract. This article introduces a rotating clamping device, using with the disassemblage machine of monomer hydraulic prop. It was used for clamping hydraulic prop, which was mainly comprised by the coupling mechanism, clamping mechanism and compressing mechanism. The coupling mechanism sleeve was bolted to the spindle. Clamping mechanism located at the end of sleeve, working with the spindle rotation. Compressing mechanism hang around the sleeve, not working with the spindle rotation. Compressing mechanism passed the clamping force through the thrust bearing, clamping the hydraulic prop. It was easy to operate. Clamping force is decentralized, the stress in cylinder was even, so the cylinders seldom distort, which reduced the impact, extending the life of the equipment.

Introduction

Hydraulic prop is an important supporter of mining enterprise, which is used wide. Maintenance is onerous, especially of demolition. Hydraulic prop disassemble machine is special equipment, which has the advantage of efficiency, less labor force and high quality of maintenance. When dealing to the rusting prop, clamping force is highly required. There are two existing ways. One is by the mechanical chuck, which is time-consuming and often needs the manual processing, even makes the cylinder scrap. The other is eccentric clamping. Although easy to operate, but the motor must reverses when releases, which cause a waste of time and the impact to the equipments. The clamping parts linear contact with the fuel tank, which is force-concentration, increased the friction of eccentric clamping and deformation of fuel tank. To restore the cylinder geometry and to avoid the scrapping of cylinder, we design the following hydraulic clamping device.

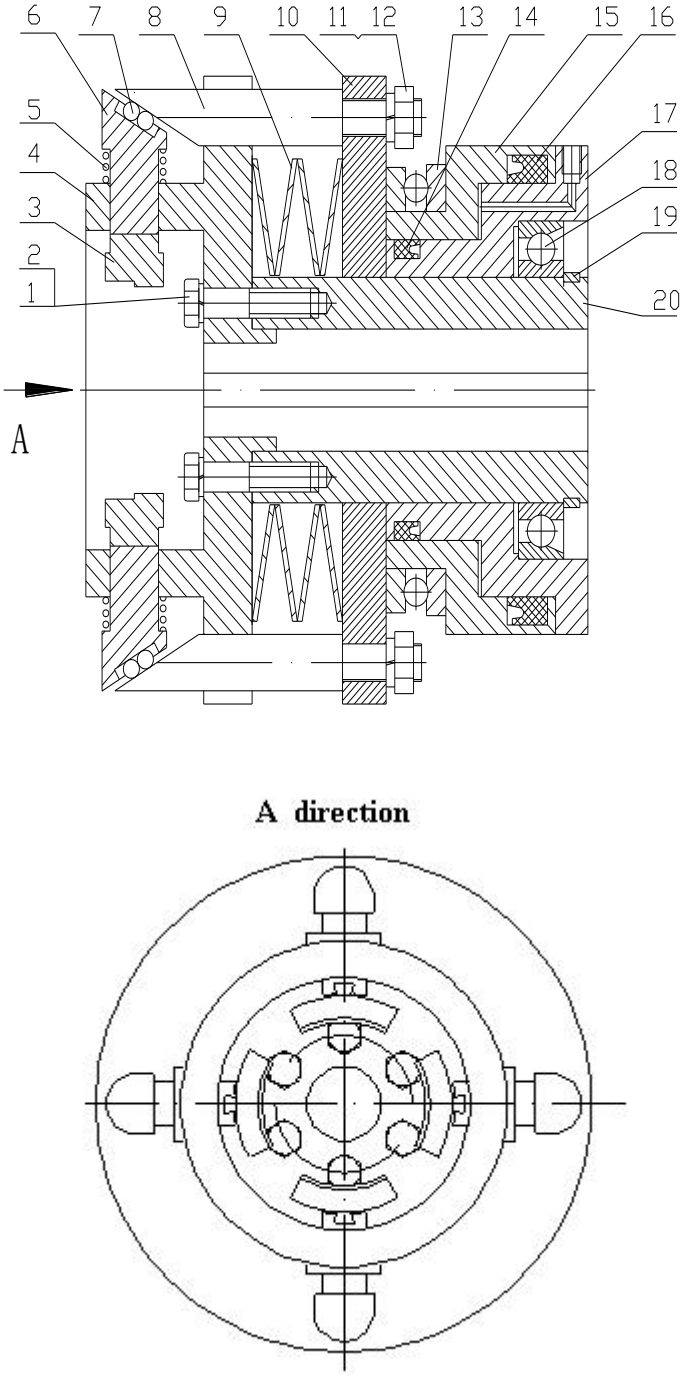
Structure Composition

The structure of rotating clamping device is shown in Fig 1, composed of the clamping block, front panel, return spring, radial connecting rod, disc-type springs, push plate, thrust ball bearing, L-shape cylinder tube L-shape piston, angular contact ball bearings and so on. Hydraulic clamping device directly links to the output shaft of the main gear of the prop demolition, used to clamp the base of hydraulic prop or reduce the velocity of electric motor through V-belt, driving the main speed reducer.

Hydraulic clamping device includes coupling mechanism, clamping mechanism and compressing mechanism. The sleeve 20 and the output shaft send the torque by the parallel key. The front plate 4 is fixed on the sleeve 20 through bolt 1and small washer 2. Clamping mechanism is located at the end of sleeve 20, both rotating with the spindle. Compressing mechanism hangs around the sleeve 20, not rotating with the spindle. It passes on the clamping force to the clamping mechanism through the thrust bearing 13, clamping the monomer hydraulic prop.

Compressing mechanism consists of the L-shaped cylinder and its control devices. Control devices control the L-shaped cylinder, then control the clamping mechanism to clamp or release hydraulic prop. L-shaped cylinder is composed of L-type cylinder tube 15, L-shape piston 17, seal

ring 14 and seal ring 16. L-shape cylinder tube 15 included the size of two ladder-shaped bore. L-shape piston 17 included the size of two step-shaped shaft. Seal ring 14 located at the left Cylindrical of the L-shape piston 17. Seal ring 16 located at the right hole of the L-shape cylinder tube 15. L-shape cylinder tube 15 connects to the thrust bearing 13, transmit the clamping force to clamp hydraulic prop. L-shape piston 17 Installed in the sleeve 20. Angular contact ball bearing 18 Located between the sleeve 20 and L-shape piston 17. Angular contact ball bearing 18 positioned on the sleeve 20 through the axial thrust ring 19.



1 bolt, 2 washers, 3 clamping block, 4 front plate, 5. Reset spring, 6 radial connecting rod, 7 steel ball, 8 axial connecting rod, 9 disc- shape spring, 10 push plate, 11 nut, 12 washer, 13 thrust ball bearing, 14. seal ring, 15 L-shape cylinder tube, 16 seal ring, 17. L-shape piston, 18 angular contact ball bearing, 19 thrust ring, 20 Axle sleeve.

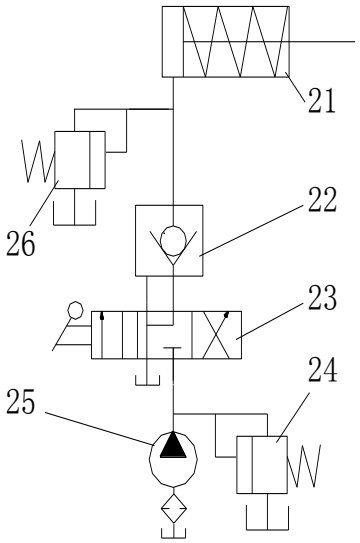
Fig. 1 The structure of rotating clamping device

Clamping mechanism include the front plate, the radial clamping mechanism, the axial clamping mechanism. The front plate 4 fixed to sleeve 20. There was a group of four axial holes at the front plate, used to assemble axial clamping mechanism. There was a group of four radial holes at the front plate, used to assemble radial clamping mechanism. The front end of the axial clamping mechanism and the radial clamping mechanism are equipped with s, compress mechanism transmit clamping force to the front of the radial clamping mechanism with ramp. Clamped hydraulic prop, Installs the steel ball 7 between the two ramps, instead of sliding friction to rolling friction, flexible movement, reducing the friction loss.

Radial clamping mechanism includes a group of clamping block 3 and the radial connecting rod 6, the end of the radial connecting rod 6 is the ramp, the other end of the radial connecting rod 6 connect the clamping block 3. The radial clamping mechanism also includes the spring 5 that reset the radial connecting rod 6. Axial clamping mechanism includes a set of axial connecting rod 8, push plate 10. The Push plate 10 is located behind the front plate 4, empty set in the sleeve 20. The axial connecting rod 8 located through a group of four axial holes in the front plate 4. Other end of the axial connecting rod 8 fixed on the plate 10 with nut 11 and washer 12. The axial clamping mechanism includes spring 9 that reset the axial connecting rod 8 through the plate 10.

Hydraulic System

The power source of the clamping mechanism is the hydraulic pump station that is supplied for the hydraulic prop disassemble machine. Hydraulic system is shown in Fig. 2. It is compose of cylinder, cone-way valve controlled by fluid, Manual direction valve , Overflow valve, hydraulic pump and Safety valve.



21 cylinder, 22 cone-way valve controlled by fluid, 23 Manual direction valve,
24 Overflow valve,25 hydraulic pump,26 Safety valve
Fig. 2 Hydraulic system diagram

When Clamping device work, manipulate the Manual direction valve 23 to the left position, the pressure oil from the hydraulic pump 25 through the valve 23, the cone-way valve controlled by fluid 22, go into the cylinders 21, L-shape piston 17 Move out, push the push plate 10, compress disc-shape spring 9, axial connecting rod 8 Move forward in the axial direction, promote the radial connecting rod 6 Move forward in the radial direction to clamp the workpiece. Manual direction valve 23 reset the middle position, the clamping mechanism maintain the clamped state.

When Need to release, manipulate the manual direction valve 23 to the right position, the pressure oil from the hydraulic pump 25 through the valve 23 go to the control port of the cone-way valve controlled by fluid 22, the cone-way valve 22 is opened, the compressed disc- shape spring 9 promote the push plate 10 Retracted loosen the clamping device, the clamping mechanism restore the original position. Overflow valve 24 is used to adjust the work pressure of the clamping device, Safety valve 26 is used to achieve Overload protection of the clamping device.

Work Process

When Clamping device work, manipulate the Manual direction valve 23 to the left position, the pressure oil from the hydraulic pump 25 through the valve 23 , the cone-way valve controlled by fluid 22,go into the cylinders 21, L-shape piston 17 Move out, push the push plate 10, compress disc- shape spring 9, axial connecting rod 8 Move to the left in the axial direction, through steel ball 7 promote the radial connecting rod 6 Move forward in the radial direction ,droved clamping block 3 to clamp the Hydraulic prop that would be disassembled. After clamping, the main motor starts, droved Axle sleeve 20, front plate 4, Reset spring 5, radial connecting rod 6, steel ball 7, axial connecting rod 8, disc- shape spring 9, push plate10 rotate. Other parts remain stationary.

When need to release, manipulate the manual direction valve 23 to the right position, the pressure oil from the hydraulic pump 25 through the valve 23 go to the control port of the cone-way valve controlled by fluid 22, the cone-way valve 22 is opened, the compressed disc- shape spring 9 promote the push plate 10 and the axial connecting rod 8 Retracted， the pressure oil Flow back into the pumping station from the cylinder 21. The Reset spring 5 promote the radial connecting rod 6 to restore the initial position. Release the hydraulic prop, the clamping mechanism restore.

Conclusion

In summary, the hydraulic clamping device used in hydraulic prop disassemble machine, It has the following advantages.

(1) Improved the mechanization level of disassembling hydraulic prop. Saving auxiliary time, Work efficiency higher.
(2) The force is even at the clamping parts, cylinder deformation is smaller.
(3) When working, manipulate the Manual direction valve can clamp workpiece, even without human clamp tight, significantly reduce labor intensity, Operation is very convenient.
(4) When need to release workpiece, without starts the main motor reverse, so that the starting numbers of the main motor and the main speed reducer reduces to original half. Extended equipment life.

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