Design of Hydraulic Master Integrated Valve Body Pouring Device for Excavator and its Application Method

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Abstract—In this paper, a new type of hydraulic master integrated valve body placement device for excavator is designed, and the application method is introduced. The traditional casting device for hydraulic master integrated valve body production of excavator has the disadvantages of constant height, inconvenient flexible adjustment and poor practicability. By setting the connecting plate, movable plate, sealing plug, pushing plate, spring, pushing column, receiving frame and fixed plate, using the motor to drive the rotating plate, the height of the treatment box is adjusted, and the quality of the pouring is improved.

Keywords—Excavator; Hydraulic system; Valve body pouring

1. Introduction

The background of excavator hydraulic master integrated valve body placement device stems from the continuous pursuit of equipment performance and efficiency in the construction machinery industry[1].The pouring device is a kind of auxiliary equipment on the excavator, which is used for pouring concrete, mortar and other materials[2].In the past, the pouring device was usually composed of scattered hydraulic control valves and piping, which was complicated in structure, cumbersome in installation, high in leakage risk and low in efficiency.

In order to improve the efficiency and reliability of construction machinery, reduce energy waste and leakage risk, construction machinery manufacturers began to develop integrated valve body placement devices. The modular design of the integrated valve body placement unit integrates multiple hydraulic control valves in one assembly, reducing the probability of leakage in the system by reducing piping and fittings. The integrated valve body can also reduce the energy loss of the hydraulic system and improve the working efficiency of the machine[3].

By integrating the valve body placement device, the excavator can operate more efficiently and stably during placement operations, thereby improving construction efficiency, reducing risk, and reducing energy consumption and cost savings. This makes the excavator hydraulic master integrated valve body pouring device become an important technological innovation in the modern construction machinery market.

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The height of the existing valve body placement device used for the production of the excavator hydraulic master integrated valve body is constant [4], which is inconvenient for flexible adjustment, resulting in poor flexibility and practicability. In addition, the valve body placement device used for the production of the excavator hydraulic master integrated valve body in the process of raw material filtration, the position of the feed is fixed, and the raw material cannot be uniformly spilled on the filter plate. It is easy to cause blockage of filter plate and reduce the quality of pouring.

Traditional construction is easy to cause waste of resources and quality defects, so higher requirements are put forward to improve the level and quality of engineering construction. In order to effectively improve the measurement accuracy of traditional measurement methods, a dynamic monitoring technology of bored pile pouring process based on multi-frequency ultrasound has been developed[5].

On the other hand, with the continuous progress of science and technology, hydraulic control technology is also developing[6]. The application of new materials, technology and intelligent control system provides the technical basis for the optimization and improvement of the hydraulic master integrated valve body placement device of excavator. The promotion of hydraulic machinery mainly depends on the processing technology of hydraulic components[7]. Through accurate electronic control and feedback mechanism, the control accuracy and response speed of the hydraulic system[8] are improved, making the operation more accurate and reliable.

In addition, the requirements of environmental protection and resource conservation also promote the development of the excavator hydraulic master integrated valve body placement device. By reducing energy consumption and waste generation, the integrated valve body placement device helps reduce the consumption of natural resources and reduces environmental pollution[9].

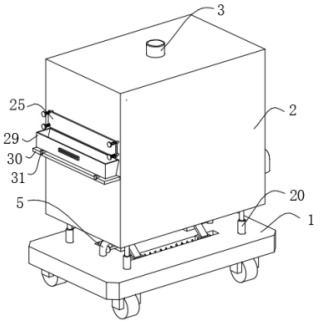
In summary, The pouring process has a huge impact on product quality[10], and the excavator hydraulic master integrated valve body pouring device is the construction machinery industry's demand for improving efficiency, reducing risk, energy saving[11] and environmental protection, as well as the continuous innovation and development of hydraulic control technology[12]. Through the design of a new excavator hydraulic master integrated valve body pouring device, by setting the connecting plate, movable plate, sealing plug, push plate, spring, push column, receiving frame and fixed plate, using the motor to drive the rotation of the rotating plate, the height of the treatment box is adjusted, and then improve the quality of the pouring, bringing more efficient, reliable and sustainable construction solutions for the construction machinery industry.

2. Design of hydraulic master integrated valve body pouring device for excavator

2.1 Excavator hydraulic master integrated valve body pouring device

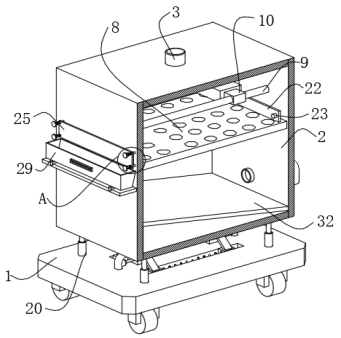
FIG.1 is the hydraulic master integrated valve body pouring device of the excavator, FIG.2 is its main section structure diagram, and FIG.3 is the enlarged diagram at A in FIG.2.Comprising

a bottom plate and a treatment box arranged above the bottom plate, the upper surface of the treatment box is connected with a feed pipe, the right side of the treatment box is connected with a discharge pipe, the discharge pipe is installed with a control valve, the treatment box is installed with a filter plate, the rear side of the treatment box is installed with a motor, and the rear side of the inner wall of the treatment box is installed with a rotating shaft fixed connection with the output shaft of the motor. The rotating shaft is installed with a rotating plate, one end of the rotating plate is hinged with a connecting plate, the processing box is installed with two support rods, the two support rods are installed with a sliding support plate, the two support plates are installed between the hollow leakage frame, the feed pipe is connected with a corrugated pipe, one end of the corrugated pipe is connected with the leakage frame, the lower surface of the leakage frame is provided with a number of leakage holes, One end of the connecting plate is rote-tingly connected with one of the supporting plates, the upper surface of the bottom plate is installed with a U-shaped sliding rod, sliding rod is installed with two sliding blocks, the upper surface of the sliding block is hinged with a movable plate, the movable plate is arranged inclined, one end of the two movable plates are hinged with the lower surface of the treatment box, and the opposite side of the vertical part of the sliding rod is installed with an electric push rod. The output shaft of the electric push rod is fixed connected with the slide block.



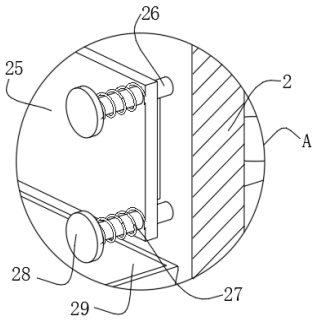
1-bottom plate, 2- handling box, 3- feed tube, 5- slide rod, 20- expansion rod, 25- mounting plate, 29- receiving frame, 30- fixed plate, 31- clamp plate

FIG. 1 Structure diagram



1-bottom plate, 2- handling box, 3- feed tube, 8- filter plate, 9- support rod, 10- support plate, 20- expansion rod, 22- push plate, 23- push column, 25- mounting plate, 29- receiving frame

FIG. 2 Schematic diagram of the main view section structure

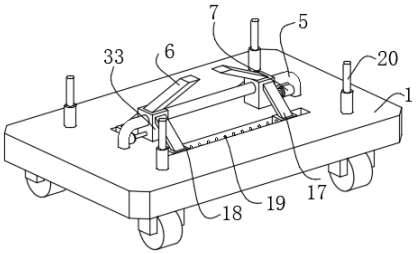


2- handling box, 25- mounting plate, 26- limit rod, 27- spring two, 28- baffle, 29- receiving frame

FIG. 3 Schematic diagram of enlarged structure at A in FIG. 2

2.2 Excavator hydraulic master integrated valve body pouring device features

(1) As shown in Figure 4, two limit slots are provided on the upper surface of the bottom plate, and the two limit slots are respectively located on the front and back sides of the slide rod. A limited position plate is installed in the limit slot, and an auxiliary plate arranged at an Angle is installed on the upper surface of the limit plate, and one end of the auxiliary plate is fixed connected with the slide block.



1- bottom plate, 5- slide rod, 6- movable plate, 7- electric push rod 1, 17- auxiliary plate, 18- limit plate, 19- spring 1, 20- expansion rod, 33- slide block

FIG. 4 Schematic diagram of the main view structure of the bottom board

(2) A spring is installed between two limit plates on the same side, and four telescopic rods are installed on the upper surface of the bottom plate, and the telescopic shaft of the telescopic rod is fixed connected with the treatment box.

(3) The left side of the processing box is provided with a channel, the channel is provided with a sealing plug, the right side of the processing box is installed with an electric push rod, the output shaft of the electric push rod extends through the processing box and is installed with a push plate.

(4) A mounting plate is arranged on the side of the sealing plug, and the four corners of the mounting plate are provided with perforations, and a limited position rod is arranged at the perforations, one end of the limit rod is fixed connected with the processing box, and a reset component is arranged on the limit rod.

(5) The reset assembly comprises two baffle plates respectively mounted on the other end of the two limit rods, the limit rod is fitted with a spring with two ends respectively fixed to the baffle plate and the treatment box, and the side of the push plate is installed with a push column.

(6) A fixed plate is arranged on the left side of the processing box phase, and the upper surface of the fixed plate is provided with a receiving frame with an opening on the upper surface, the receiving frame is located below the mounting plate, and the side of the receiving frame is fitted with the processing box.

(7) Two card slots are arranged on the upper surface of the fixed plate, and a card plate is arranged in the card slot, and the card plate is installed on the lower surface of the receiving frame.

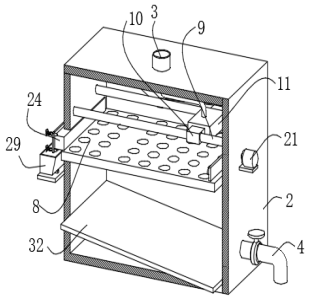
(8) A deflector plate is arranged in the processing box, and one end of the discharge pipe conflicts with the deflector plate.

3. Structure analysis of excavator hydraulic master integrated valve body pouring device

This paper provides an integrated valve body pouring device for excavator hydraulic main control, including a bottom plate and a treatment box arranged above the bottom plate. The upper surface of the treatment box is connected with a feed pipe, the right side of the treatment box is connected with an discharge pipe, the discharge pipe is installed with a control valve, and the treatment box is installed with a filter plate to filter impurities in the raw materials. The rear side of the treatment box is installed with a motor, the motor is used to drive the rotating shaft for rotation, the rear side of the inner wall of the treatment box is installed with a rotating shaft fixed connection with the motor output shaft, the rotating shaft is used to drive the rotating plate to rotate, the rotating shaft is installed with a rotating plate, one end of the rotating plate is hinged with a connecting plate, the support plate is connected with one end of the connecting plate, and then the missing frame is connected. Two support rods are installed in the treatment box, and the support plates are supported by the support rods. The support plates are sliding on both support rods, and a hollow leakage frame is installed between the two support plates. One end of the feed pipe is connected with a corrugated pipe, and one end of the corrugated pipe is connected with the leakage frame. The upper surface of the bottom plate is installed with a U-shaped sliding rod, sliding rod is installed with two sliding blocks, the upper surface of the sliding block is hinged with a movable plate, the movable plate is arranged inclined, one end of the two movable plates are hinged with the lower surface of the treatment box, the opposite side of the vertical part of the sliding rod is installed with an electric push rod, the use of electric push rod to drive the slider to move, The output shaft of the electric push rod is fixed and connected with the slider. By setting the connecting plate and the movable plate, the motor is used to drive the rotating plate to rotate, and then drive one end of the connecting plate to rotate. Combined with the rotating connection between one end of the rotating plate and one of the supporting plates, the leakage frame moves left and right under the driving of the connecting plate with the rotation of the rotating plate, and then the raw materials are evenly scattered on the filter plate. Combined with the function of driving the slider on the slide rod, the height of the treatment box is adjusted through the hinged connection between the movable plate and the treatment box, and then the quality of the pouring is improved.

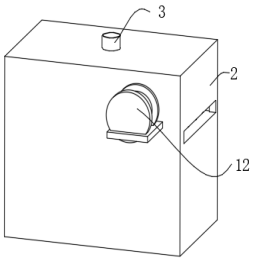
The upper surface of the bottom plate is provided with two limit slots, the two limit slots are respectively located on the front and back sides of the slide rod, and the limit slot is sliding to install the limited position plate, and the bottom end of the auxiliary plate is supported by sliding one end of the limit plate in the limit slot. The upper surface of the limit plate is installed with an auxiliary plate arranged at an Angle, and the auxiliary plate is used to support the slide block. One end of the auxiliary plate is fixed connected with the slide block. By setting the limit plate and the auxiliary plate, the auxiliary plate is used to provide the limit support for the slide block, so that the slide block slides stably on the slide bar. Combined with the function of the limit plate sliding in the limit slot, the auxiliary plate moves with the movement of the slide block and the structure is simple.

A spring is installed between the two limit plates on the same side, using the spring to control the speed of movement between the two limit plates, the upper surface of the bottom plate is installed with four telescopic rods, using the telescopic rod to strengthen the support of the treatment box, the telescopic shaft of the telescopic rod is fixed connected with the treatment box, by setting the spring and the telescopic rod, using the spring installed between the two limit plates on the same side, The speed of the limit plate sliding in the limit slot is controlled to further slow down the sliding speed of the slider on the slide rod, improve the stability of the treatment box when moving, combined with the function of the telescopic rod, strengthen the support around the treatment box to avoid the phenomenon of the treatment box tilting to one side.



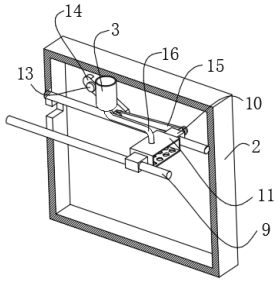
2-processing box, 3-feed tube, 4-discharge tube, 8-filter plate, 9-support rod, 10-support plate, 11-leakage frame, 21-electric push rod II, 29-receiving frame, 32-deflector plate

FIG. 5 Schematic diagram of the side-view structure of the processing bin



2-processing box, 3-feed tube, 12-motor

FIG. 6 Structure diagram of the rear view of the processing box



2-processing box, 3-feed tube, 9-support rod, 10-support plate, 11-leakage frame, 13-rotating shaft, 14-rotating plate, 15-connecting plate, 16-bellows

FIG. 7 Structure diagram of the side view section of the treatment box

As shown in FIG. 5, FIG. 6 and FIG. 7, a channel is provided on the left side of the treatment box, and a sealing plug is arranged at the channel. An electric push rod 2 is installed on the right side of the treatment box, and the output shaft of the electric push rod 2 extends through the treatment box and a pushing plate is installed. The material blocked on the surface of the filter plate is cleaned, and the push plate is moved above the filter plate through the drive of the two output shafts of the electric push rod, and then the material is pushed to the left side of the treatment box, and the treatment box is discharged in combination with the role of the channel.

A mounting plate is installed on the side of the sealing plug, and the four corners of the mounting plate are provided with perforating holes, and a limited position rod is arranged at the perforating hole, one end of the limiting rod is fixed connected with the processing box, and a reset component is arranged on the limiting rod. By setting the mounting plate and the limiting rod, the limiting rod is used to pass through the perforating hole, so that the mounting plate slides on the limiting rod when the sealing plug is moved out of the channel. The sealing plug is further supported to improve the stability of the sealing plug.

The reset component comprises two baffle plates respectively installed on the other end of the two limit rods, the limit rod is connected with the two ends of the baffle plate and the processing box fixed connection of the spring two, the side of the push plate is installed with a push column, by setting the spring two and the push column, the use of the spring two sleeve on the limit rod, so that the mounting plate with the movement of the seal plug to squeeze the spring two, The sealing plug is quickly returned to the channel by the reaction force of the spring two, and then the channel is sealed in time, and the sealing plug is removed from the channel by the auxiliary pushing plate combined with the role of the pushing column, so that the material blocked on the filter plate can be quickly discharged.

A fixed plate is installed on the left side of the processing box phase, and the upper surface of the fixed plate is provided with a receiving frame with an opening on the upper surface. The receiving frame is located below the mounting plate, and the side of the receiving frame is fitted with the processing box. By setting the receiving frame and the fixed plate, the fixed plate is used to support the receiving frame, so that the receiving frame can be temporarily fixed on the processing box. Combined with the role of the receiving frame located under the mounting plate, the materials discharged in the channel are collected in a unified manner, which is convenient

for the staff to handle the discharged materials in a unified manner, and brings great convenience to the staff.

The upper surface of the fixed plate is provided with two card slots, and the card slots are provided with a card plate, and the card plate is installed on the lower surface of the receiving frame. By setting the card plate and using the sliding effect of the card plate in the card slot, the position of the receiving frame is fixed on the fixed plate on the one hand, so that the card plate is stably fixed on the fixed plate on the other hand, the receiving frame is limited to support, so that the receiving frame can be stably received. Improve the stability of the receiving frame.

A deflector plate is installed in the processing box, and the deflector plate is inclined to be arranged, and one end of the discharge tube conflicts with the deflector plate. By setting the deflector plate and taking advantage of the inclined layout of the deflector plate, the downward dripping raw materials are guided, so that the raw materials are concentrated to one side, which is convenient for the raw materials to pass through the discharge tube and discharge the treatment box quickly, and the discharge rate of the discharge tube is improved. Avoid raw material residue inside the treatment tank affecting the next use.

4. Application scheme of excavator hydraulic master integrated valve body pouring device

As shown in FIG. 8, the use method of the excavator hydraulic master integrated valve body pouring device includes the following steps:

FIG.8 Excavator hydraulic master integrated valve body pouring device use steps

(1) Feed: Start the motor, the motor drives the rotating shaft to rotate, and the rotating shaft drives the rotating plate to rotate. When the rotating plate rotates, one end of the connecting plate is driven to rotate, and the other end of the connecting plate drives the leakage frame to move. When the leakage frame moves, the supporting plate is driven to slide on the supporting rod.

(2) Filtration: The raw materials are put into the leakage frame through the feed pipe, and evenly sprinkled on the filter plate through the movement of the leakage frame, and the filtered raw materials fall onto the deflector.

(3) Pouring: Starts a electric putter, an output shaft drive electric draw stem and slider sliding the slider, slider driven auxiliary board when it moves, the auxiliary plate drive limit board in the limit sliding groove, limit slabs spring by extruding, slider sliding gradually move at the end of the driver board, when the processing box function gradually move up by activity board, adjusted to deal with the height of the box, Close the electric push rod one after adjustment.

(4) Discharge: Then move the treatment box, move the discharge pipe to the appropriate position, open the control valve, and discharge the raw material through the discharge pipe to the treatment box.

(5) Clear: When the materials on the filter plate are cleaned, the electric push rod 2 is started, the electric push rod 2 drives the push plate to move, the push plate moves the materials piled on the filter plate, and pushes them to the left side. The push column conflicts with the movement of the push plate, the seal plug is pushed out of the channel, the material falls through the channel into the receiving frame, and then the push plate is reset. The sealing plug is quickly returned to the channel by the reaction force of spring 2, and re-seals the channel, and then moves the receiving frame to one side. When the receiving frame moves, the card plate is driven to slide in the card slot, so that the card plate is removed from the card slot, and then the materials in the receiving frame can be cleaned.

5. Conclusion

The hydraulic master integrated valve body placement device of excavator and its application method proposed in this paper solve the problem of constant height of the traditional valve body placement device used in the production of hydraulic master integrated valve body of excavator by setting connecting plate, movable plate, sealing plug, push plate, spring, push column, receiving frame and fixing plate, which is inconvenient for flexible adjustment, resulting in poor flexibility and practicability. In the process of raw material filtration, the position of the feeding material is fixed, and the raw material can not be evenly sprinkled on the filter plate, which is easy to cause the blockage of the filter plate and reduce the quality of the pouring.

In the future, through the introduction of sensors, monitoring systems and artificial intelligence technology, the unit will be able to achieve more advanced self-detection, fault prediction and fault handling capabilities, while achieving more precise and automated control, improving the efficiency and quality of construction.

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