Design and Research of Sorting Device for Change Back Meter

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Abstract. Design and research a sorting device for dismantling electric energy meter. The gripping mechanism of the gripping electric energy meter is designed. By moving and rotating, multiple electric energy meters can be caught to different positions, and the sorting efficiency is improved. Set up a second line body to provide multiple blanking positions for placing different fault types to solve the problem of single sorting position. The lifting mechanism and the supporting plate are set, and the lifting and lowering mechanism of the lifting mechanism is controlled by the control system, so that the electric energy meters are equidistantly classified, the beat of the unloading is controlled, and the unloading requirements of the unloading robot are met.

1. Introduction
With the large-scale installation and application of smart energy meters and periodic rotation, the number of faulty smart energy meters to be dismantled is also increasing. The change back meters need to be sorted and tested to analyze and judge the operating state and fault conditions of the intelligent electric energy meters to determine the recycling situation of the dismantled electric meters. The sorting business of dismantling electric energy meters has gradually become one of the key tasks of the provincial metrology center.

The intelligent electric energy meter sorting detection device is a device for detecting the quality failure of the smart electric energy meter equipment dismantled on the spot, and its basic detection process includes data detection and collection, labeling and sorting. However, in the prior art, the following problems exist at the sorting end: in the prior art, a sorting robot or a three-axis mobile platform is used for sorting, and only one piece of electrical energy or one state of energy meter can be sorted at a time, and the sorting efficiency is slow. Can't meet the requirements of sorting back table. The sorting position is single, and the energy meter cannot be sorted to multiple loading positions. The energy meter cannot be classified at equal intervals, and cannot meet the requirements of the blanking robot. Therefore, a sorting device capable of sorting with high efficiency, sorting energy meters to multiple discharge positions according to the types to be repaired, to be compensated, to be scrapped and to be verified, and to classify the energy meters at equal intervals. The design and research of the intelligent electric energy meter sorting detection device has good social value and economic benefit, and has broad application prospects.

2. Structural design of the sorting device for change back meter
The sorting device of the change back meter mainly includes a device frame mechanism, a clamping jaw mechanism, a feeding mechanism, a sorting and placing mechanism, and a sorting device control system. The structural diagram of the sorting device for the change back meter is shown in Figure 1.
The structure of the clamping claw mechanism of the sorting device of the electric energy meter is shown in FIG. 2. The clamping claw mechanism provided on the frame body is mainly used for grasping the electric energy meter. A bar code is attached to the electric energy meter, and a code scanning mechanism is provided on the clamping jaw mechanism for scanning the bar code information on the electric energy meter. The clamping jaw mechanism includes a pair of linear guide rails arranged longitudinally; the linear guide rails are arranged on both sides of the upper end of the frame body, and both ends of the linear guide rail are fixedly connected to the frame body. The linear guide rails are all provided with a slider, and the slider is connected with a driving mechanism, and the driving mechanism is a single-axis driver. The single-axis drive is arranged parallel to the linear guide rail and fixedly connected to the frame body, and the single-axis driver is connected to the slider. Single-axis drives are single-axis robots, also known as single-axis robots, electric slides, linear modules, single-axis drives, etc.

The slider is also connected with a clamping jaw module, and the clamping jaw module includes a horizontally arranged beam, and the beam is fixedly arranged above the slider. A rotating cylinder is arranged below the crossbeam, the rotating cylinder is fixedly connected with a first connecting plate,
and a lifting cylinder is provided on the first connecting plate. A second connecting plate is connected to the lifting cylinder, and a clamping jaw driven by the clamping cylinder is provided on the second connecting plate. Among them, the rotary cylinder is used to rotate the jaws to adjust the position, the lifting cylinder is used to move the jaws up and down, and the single-axis driver is used to drive the jaw module to move along the linear guide rail.

The disassembled electric energy meter sorting device includes a feeding mechanism, which is arranged below the linear guide rail. The feeding mechanism includes a tray containing an electric energy meter, and 6 electric energy meters can be placed on the tray, and the electric energy meters are arranged symmetrically. It is convenient for two clamping jaw modules to grab the electric energy meter. The structure of the pallet with the electric energy meter sorting device removed is shown in Figure 3.

![Figure 3](image.png)

**Figure 3.** Schematic diagram of tray structure.

The tray is arranged on the first thread body, that is, the first thread body drives the tray to circulate. The first wire body is arranged laterally and extends through the inside of the rack body to the outside of the rack body. The first wire body is also provided with a stop device to stop the tray, which is convenient for the gripper to pick up the electric energy meter. The stopping device includes a limit baffle provided on the first wire body, and the limit baffle is driven by the first cylinder. The device also includes a top plate, the top plate is fixedly welded on the first wire body, and is provided corresponding to the limit baffle. The first cylinder pushes the limit baffle to move, so that the tray is clamped between the limit baffle and the top plate, and the tray stops. The device also includes a sorting and placing mechanism. The sorting and placing mechanism includes four second line bodies arranged side by side, which are respectively used to place the sorted out fault energy meters.

Belts are provided on both sides of the second wire body, and a cavity penetrating up and down is provided in the middle. A support plate is provided in the cavity of the second wire body. A lifting mechanism is provided at the bottom of the support plate to drive the support plate to move up and down. The schematic diagram of the lifting mechanism of the sorting device of the change back meter is shown in Figure 4. The jacking mechanism includes a supporting frame, which is fixedly connected to the frame body, and a jacking cylinder is provided above the supporting frame, and the jacking cylinder is connected to the supporting plate.
3. **Structural design of the sorting device for change back meter**

The sorting device of the change back meter is designed with an intelligent control system. The control system includes an information recognition module for recognizing bar code information, and controls the gripper mechanism to place the electric energy meter on different second wires according to the fault type on the bar code information. At the same time, the control system is electrically connected to the code scanning mechanism, the jacking mechanism, and the stop and stop device, respectively, and performs corresponding control. The flow chart of the control system of the sorting device for the change back meter is shown in Figure 5.

![Diagram of the sorting device](image)

**Figure 4.** Structure diagram of jacking mechanism.

**Figure 5.** Flow chart of control system.

The control system includes an information recognition module, and the barcode information scanned by the code scanning mechanism is transmitted to the control system. The information identification module is used for identifying barcode information, and controls the gripper mechanism to place the energy meter on different second wires according to the type of failure on the barcode information, so as to realize the classification of energy meters with different faults. The control system is connected to the jacking mechanism at the same time, controls the lifting of the jacking mechanism, realizes the equal interval classification of the electric energy meter, and controls the beat of removing the blanking to meet the blanking robot blanking requirements. In use, the gripper grabs the electric energy and moves the electric energy meter to the corresponding second line body according to the fault type. At this time, the lifting cylinder lifts the support plate so that the support plate is higher than the second line body belt. Place the electric energy meter on the support plate on the wire body, and then control the lifting cylinder to lower it. As the supporting plate is lowered, the electric energy meter is in contact with the belt of the second wire body and flows as the belt rotates. By setting the jacking mechanism and the supporting plate, the distance control of the electric energy meter is realized. The
control system is also electrically connected with the first cylinder to control the stop device to realize the stop of the tray.

4. Sorting method of change back meter
Remove the energy meter sorting device and place the energy meter with the barcode on the tray. The tray will flow with the first thread. When the tray runs to the position of the stop device, the control system controls the stop device and the tray is stopped. The control system controls the gripper mechanism to work, grips the electric energy meter, and recognizes the code scanning information on the electric energy meter through the code scanning mechanism and transmits the information to the control system. The control system identifies the corresponding fault type according to the barcode information, and at the same time controls the jacking mechanism on the corresponding second wire body to raise the support plate.

Then, the clamping jaw mechanism places the clamped electric energy meter on the supporting plate. The control system controls the jacking mechanism to move the supporting plate downward, which in turn drives the electric energy meter downward. With the downward movement of the electric energy meter, the electric energy meter is in contact with the second wire body. At this time, the second wire body drives the flow of the electric energy meter, and the distance control of the electric energy meter is realized.

5. Conclusion
This paper analyzes and studies a sorting device and method for dismantling the electric energy meter. The sorting device includes a device frame mechanism, a gripper mechanism for grasping the electric energy meter, and a feeding mechanism for driving the electric energy meter to be sorted for circulation. It is used to place the classified placement mechanism according to the electric energy meter and the sorting device control system mechanism. Among them, the control system is used to control the clamping jaw mechanism to place the electric energy meter on a different second wire body, and at the same time, the control system is connected to the lifting mechanism to control the lifting of the lifting mechanism. The analysis and research of the disassembled electric energy meter sorting device in this paper is enough to meet the needs of intelligent industrial production.

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