A New Type of Electronic Induction Anti-misoperation Grounding Wire Device

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Abstract

This scheme transforms based on conventional ground device. A pressure sensor is installed on the top of the lock at the grounding end. When to close the lock head and spin metal screw rod, its pressure increases to a certain value, so that it can send the appropriate instruction to the line end control system through the Zigbee module, which makes the pick line end control system to control on the insulated handle control lock open. At this time, the grounding wire handle at the wire end can be moved freely to facilitate the operation of connecting wire. The new electronic induction anti-misoperation grounding wire device can effectively prevent the occurrence of "hanging grounding wire when live" accident. At the same time, it can standardize the sequence of wiring clamp and grounding clamp when installing and dismantling the grounding wire, forming a complete constraint system. The device has the advantages of simple structure, convenient installation, simple steps to use, and will not increase the workload of the operator. It has strong practicability and can be widely applied in the power system.

Keywords

Electronic; Error Protected; Grounding Line; Zigbee Module.

1. Introduction

The maintenance of power system equipment is a work which needs high safety requirements, and the primary focus is to install and dismantle the grounding wire safely in place. Ground wire is the lifeline to ensure the personal safety of electrical workers. The installation and disassembly of ground wire is a dangerous operation in electrical operation. It is not uncommon to see accidents of electric shock and falling from high altitude when electrified connecting ground wire or sending power with ground wire or installing ground terminal of ground wire in power system, and it is also the main source of accidents of man-made equipment and personal casualties. Before and after the maintenance work, the grounding wire should be installed and dismantled and stored in place in time. In the maintenance work, in the event of accidental hanging, accidental dismantling, omission and other situations, even if only once, it will cause great losses to the maintenance work and even endanger the life safety of personnel. Therefore, it is an important task for substation to install and disassemble the grounding wire correctly.

At present, most electric power enterprises have made some basic requirements for the use of ground wire in the system, but the specific management of ground wire is not standardized enough :(1) the existing various ground wire management devices can only directly prevent the misoperation accident of "closing with ground wire (power transmission)"; Although the switch down operation system is complete, it is difficult to avoid the factor of artificial error during the operation of grounding wire. For a long time, it has been impossible to eliminate the malignant misoperation accident of " hanging grounding wire when live " caused by artificial error. (2) The sequence of grounding wire installation and dismantling depends on manual checking, and there is a lack of effective technical means or measures.

1.1 Practical operation of ground wire in power system

(1) When hanging the grounding wire, the workers connects the grounding clamp first, then connects the wiring clamp; When removing the grounding wire, the wiring clamp must be removed first and then the grounding clamp must be removed according to the program.

(2) Installation: fix the copper noses of the two eyes on the phase separation of the soft grounding copper wire to the corresponding positions of the wiring clamps (wiring clamps have fixed and movable types) on the grounding rod to form a complete set of grounding wires, as shown in Figure 1.

Fig. 1 Ground wire

(3) Verify whether the voltage level of the grounding rod is consistent with the voltage level of the operating equipment.

(4) Generally, there are two people working together on the ground wire operation site. One of them is responsible for locking, and the other person records the data in the ground wire usage table of the power grid. At the same time, the person responsible for recording the data also plays the function of providing safety care for the personnel connecting the lock.

1.2 Current insufficiency of grounding wire operation

(1) It is difficult to avoid the artificial error factor when the grounding wire is attached to the existing grounding wire devices. For a long time, it has always been impossible to put an end to the artificial error caused by " hanging grounding wire when live " malignant misoperation accident.

(2) The sequence of grounding wire installation and dismantling depends on manual checking and lacks effective technical means or measures.

2. Organization of the Text

This project is mainly to solve is to furnish the order of the grounding line, considering the complex environment, cost, safety and other aspects, according to the existing problem, we prepared on the basis of the existing earthing wire device, design new electronic induction earth wire maloperation prevention device which create a way to prevent wrong order and it can realize operation when installation "hang ground, before hanging terminal". The operation sequence is regulated from the hardware.

The new electronic induction ground wire anti-misoperation device is an operation device to realize the correct connection through pressure sensing between the ground end and the wiring end. The overall structure of the device is shown in Fig. 2 (Fig. 3 is the physical figure). The connecting wire end is provided with a locking mechanism (Fig. 2(a)), and the grounding end is equipped with a

pressure sensor. ZigBee wireless duplex transceiver module is adopted between the two to form point-to-point communication and realize the logical relationship between the two actions.

At the beginning of maintenance, if the staff starts to work from the ground end, the metal screw of the ground end needs to be rotated positively first. The pressure sensor on the top of the lock head senses the external pressure and the pressure value gradually increases. When it reaches its maximum f_m (f_m measured by experiment, it represents that grounding has completely locks, lock can be safely used) , it sends the corresponding instruction to the line end control system through the Zigbee module, and then the pick line end control system control on the insulated handle lock to open, leading the ground wire handle free activities, so that the staff can connect the wires. If the staff want to start the installation from the ground end, they will find that the terminal is locked and cannot work properly. Therefore, the operation installation "hang the ground end first, then hang the wiring end", from the hardware specification of the operation sequence, to achieve the purpose of operation.

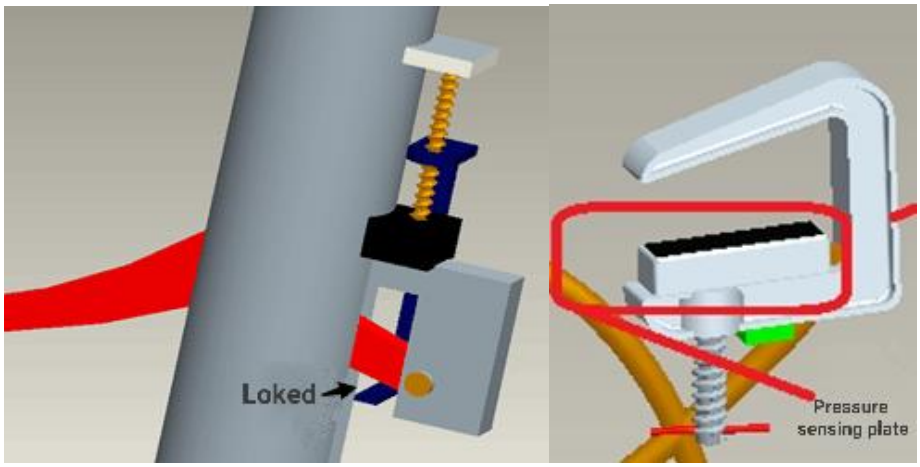
This device is suitable for use in substation, distribution station and power line of power system, which improves the safety management level of substation ground wire, enhances the control of the use of ground wire on power line, standardizes the operation process of ground wire, and eliminates safety risks such as " hanging grounding wire when live " and "wrong operation sequence".

2.1 The grounding end

The grounding terminal is composed of a grounding lock head, a pressure sensor, a 51 single-chip chip module and a ZigBee module.

A pressure sensor is on the top of the lock head at the ground end. When the lock head is to be closed and the metal screw is rotated positively, the pressure sensor on the top of the lock head senses external pressure so that the pressure value gradually increases from zero. When it reaches its maximum f_m (f_m measured by experiment, it represents that grounding has completely locks, lock can be safely used) , it sends the corresponding instruction to the line end control system through the Zigbee module, and then the pick line end control system control on the insulated handle lock to open, leading the ground wire handle free activities, so that workers can connect the wires.

When the worker want to dismantle the lock, the wire side handle free activities, so that the demolition of the wire end smoothly down the ground. When to open the lock head and turn the metal screw, the f value decreased from f_m to zero, at the same time it sends the appropriate instruction to the line end control system through the Zigbee module, making the control line end control system of short line segments on insulated handle control lock closed. It is forbidden to carry out wire connection work, so as to ensure that outdoor grounding work is carried out in accordance with the process of connecting the ground wire first and then connecting the wire, dismantling the wire first and then dismantling the ground wire.



(a) Connecting wire lock diagram (b) Ground wire lock diagram

Fig. 2 Ground wire structure diagram

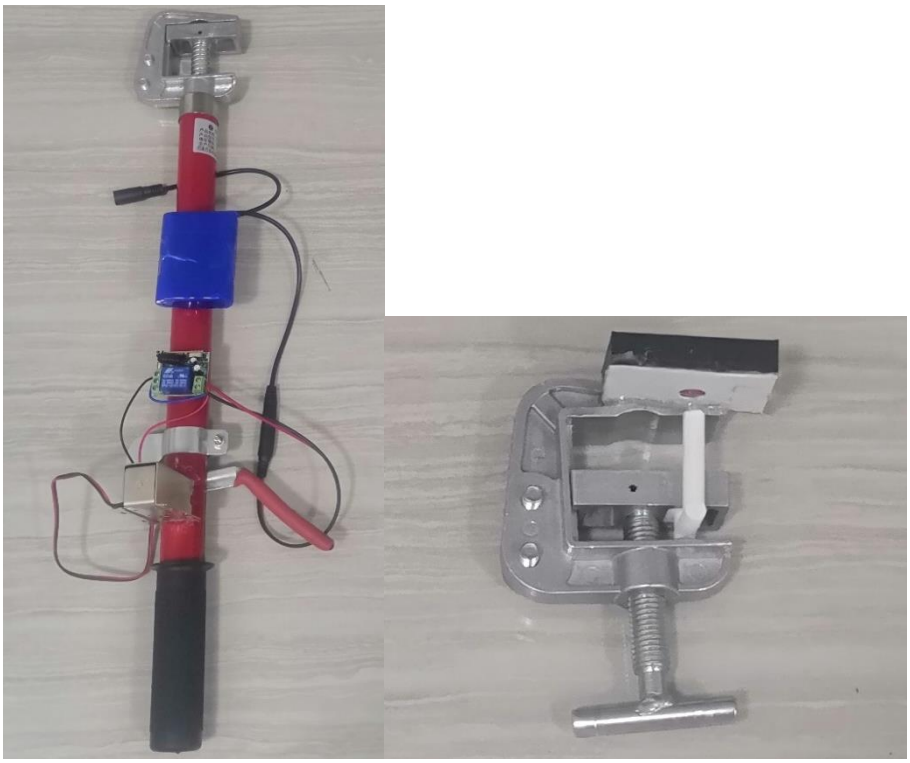


Fig. 3 Physical diagram of grounding wire

2.2 Terminal

Control lock structure: due to the short stroke of the handle at the handle fulcrum side and the special structure of the handle, the structure as shown in Fig. 2 (a) is installed at the handle fulcrum side. The overall device is small in volume and simple in structure. Working principle: When the grounding end is completed, when the control lock receives the signal from the ZigBee module at the grounding end, the stepping motor drives the lock hook down, then the handle can move freely. When the grounding end is removed, the stepping motor drives the lock hook up, so that the handle is stuck. The overall structure is shown in Figure 4.

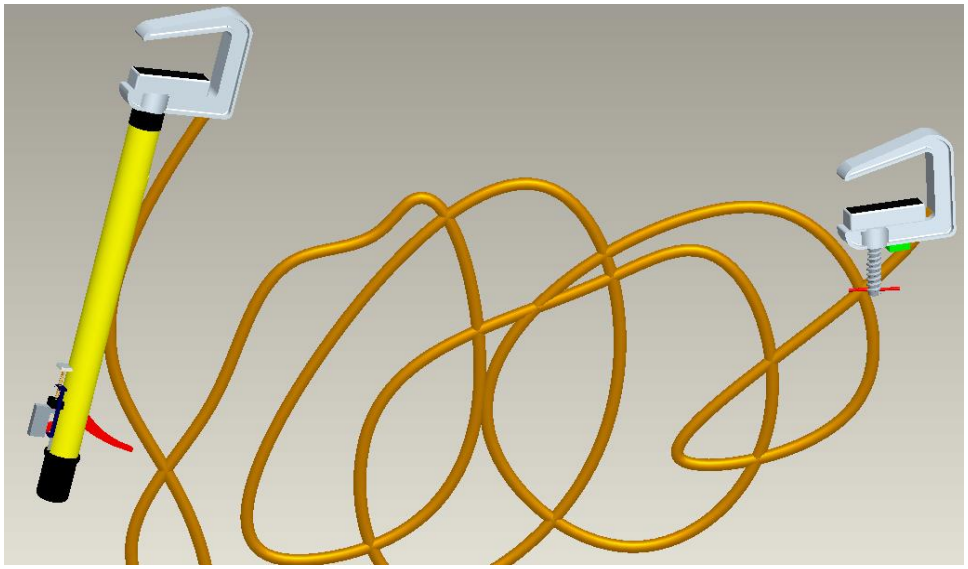


Fig. 4 3D effect drawing

The single-chip microcomputer is mainly used to realize the anti-error control of the lock, and the ZigBee module is used to realize the signal transmission. The use of the pressure sensor can ensure

that the wiring used is installed in place, completely avoiding the situation that the wiring is loose or not in place. However, there is instability in the signal transmission when it is used on site, and the anti-vibration performance of the device is poor.

3. Innovation points and applications of the device

3.1 Safe and reliable

There are sensitive pressure sensors at the terminals for sending signals. If the connection sequence is wrong, the terminal cannot be successfully connected. It can effectively eliminate the wrong operation accident caused by the wrong sequence of the grounding end and the wiring end. The safety performance is greatly improved.

3.2 Signal transmission tool

Through signal transmission, it can penetrate some walls and be used inside and outside the walls. ZigBee has low power consumption, simple protocol, greatly reduced cost, short delay, reliable data transmission and other characteristics.

3.3 Low cost, with promotion and application value

This electronic induction grounding device, compared with the conventional grounding device, the cost is not much more, but the safety performance is greatly improved. The device has the advantages of simple structure, convenient installation, simple operation steps, and will not increase the workload of the operator. It has strong practicability and good promotion value and application prospect.

4. Conclusions

Workers' in-situ operation proved that the new ground wire protection anti-misoperation device can effectively prevent the happening of the accident "hanging grounding wire when live". At the same time, it greatly improves the operation efficiency and gets the praise of the operation personnel. It can solve the problem of the order of installed and demolition of the grounding line wiring and grounding clip, forming a complete set of constraint system. The new anti-misoperation device of ground wire designed in this project has the advantages of simple structure, convenient installation and simple operation steps, which will not increase the workload of operators. It has strong practicability and ready-to-use, and has good promotion value and application prospect.

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