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Electric Self-locking Ground Clip for Maintenance of High Voltage Transmission Lines

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Abstract

In the maintenance of high voltage transmission lines, the ground clip is often used as the protection of temporary grounding during maintenance and construction [1]. However, now commonly used ground clip is basically manual operation, manual operation of the ground clip has the disadvantage of large working intensity, high risk coefficient [2]. Therefore, in this paper, we propose a kind of electric self-locking ground clip, which is used to solve the shortcomings of the existing ground clip. The ground clip proposed by us is enabled by the driving motor control fixture to reduce the working intensity of the staff, and because the screw is connected with the transmission piece by thread, it realizes the self-locking function and improves the safety of use.

Keywords

Ground Clip; Motor; Self-locking.

1. Introduction

Electric power system is one of the most important and complex engineering systems in modern society, and also an important symbol of the progress of modern civilization. Therefore, high-voltage transmission lines play an important role in economy and people's livelihood. However, in the daily operation of the power grid, the failure of the high-voltage transmission lines is inevitable, which requires the staff to repair them. And because the voltage is too high, if the maintenance process is not grounded, it will seriously endanger the safety of the staff [3].

In the daily maintenance process of high-voltage transmission lines, the commonly used ground clip, whether it is spring pressing type, screw pressing type, flat mouth type or jaw mouth type, is basically manually operated [4].

Manually operated ground clip has the following disadvantages:

1) Manual operation requires staff to have a strong ability, at the same time the work intensity is large, the operation process is dangerous.

2) Most of the ground clip that need manual operation lack self-locking mechanism, which is not safe.

Therefore, the market is in urgent need of a new type of ground clip to solve the above problems.

2. Function and Structure of Electric and Self - locking Ground Clip

2.1. Function of Electric and Self - locking Ground Clip

This paper provides a kind of electric and self - locking ground clip to solve the technical problems of the existing ground clip:

1) by driving the motor to control the start of the ground clip, reduce the working intensity of the staff.

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2) screw and transmission parts are threaded connection, realize self-locking function, improve the safety of use.

2.2. Structure of Electric and Self - locking Ground Clip

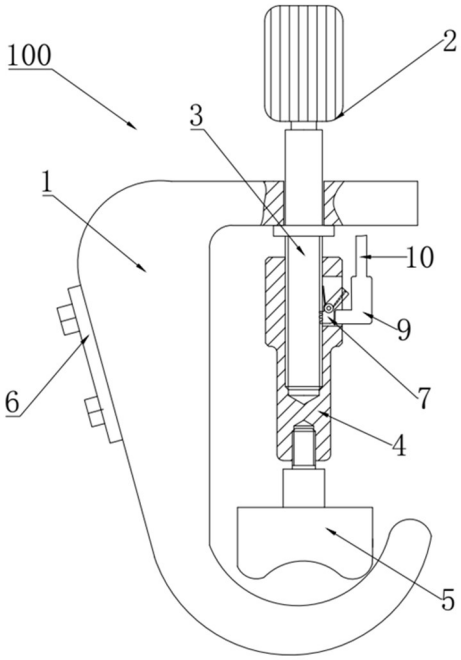

Fig. 1 Electric and self - locking ground clip structure drawing

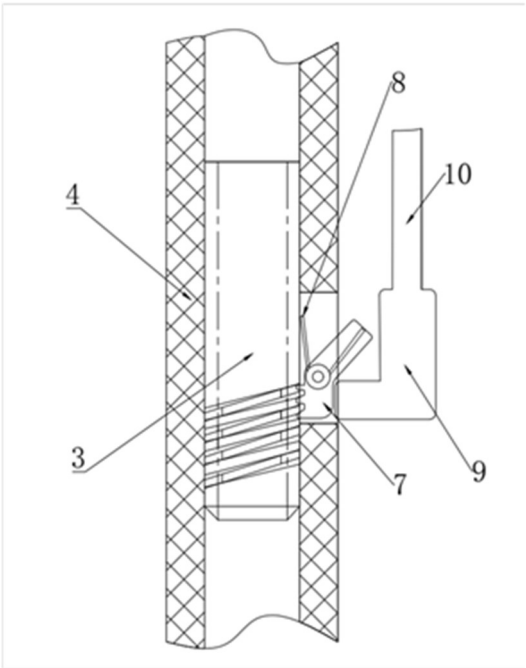

Fig. 2 Enlarged view of self-locking part of the structure

As shown in Figure 1 and 2, a kind of electric self-locking ground clip provided in this paper includes:

1- hook part ;2 – motor; 3 - screw; 4- transmission part; 5 - fixture; 6- conductive sheet;7 - ratchet; 8- reset torsion spring; 9- reset block; 10- reset pull rope; 100- electric self-locking ground clip.

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3. Implementation of Electric Part

For the electric control effect mentioned above, it is realized like this:

Staff place the hook part first to the appropriate location (that is, the wire between the fixture and hook part), and then start the motor, the rotation of the drive motor drive screw rotation, screw rotation makes a move down the transmission part, so as to make the transmission part drive fixture to hook part near, until the fixture and the hook part hold the wire firmly in place. When the transmission line maintenance is completed, only need to control the motor to reverse turn and loosen the wire, and then take off the hook part and the various devices above it.

In this ground clip, the motor is DC motor. Because the screw drive has a good self-locking, and the whole device needs little power, so we use ordinary miniature DC motor. The ordinary miniature DC motor has the advantages of large torque, low noise, small volume, light weight, easy to use, constant speed and so on.

At the same time, in order to effectively prevent the motor continues to rotate after clamping the wire, resulting in damage to the driving motor and other consequences. The DC motor is provided with an ammeter. The specific connection relation is the DC ammeter whose range in series is greater than the load current and stall current of the DC motor in the dc motor circuit. The ammeter is electrically connected to the controller. The reason for this setting is that the load current of the DC motor is different from the size of stall current, generally stall current will be larger than the load current, when clamped to a position (where the wire is clamped), the load current becomes the stall current, and the ammeter can detect the change in current, thus controlling the controller to turn off the drive motor.

4. Implementation of Self-locking part

For the self-locking effect mentioned above, it is implemented like this:

The transmission part is provided with a groove, the width of the groove and the diameter of the screw matching, the screw can be sliding connected to the inner wall of the groove, and one side of the groove is provided with a hole, there is a pawl in the hole, the pawl is fixed on the side wall of the hole through the pin shaft, and the pawl is provided with a threaded part, which can engage with the screw. Since the thread connection has self-locking function, the ground clip realizes self-locking.

When the motor fails and the fixture cannot release the wire, only the pawl needs to be tweaked so that the threaded part of the pawl does not engage with the screw. Because the driving part and the screw are sliding connection, when the screw connection is removed, the driving part and the screw are separated from each other, the motor and hook part are retrieved by staff, and the transmission part and fixture fall off for staff on the ground to pick up.

The first end of the reset torsion spring is fixed on the pawl, and the second end of the reset torsion spring is fixed on the transmission piece. Setting the reset torsion spring has two advantages: 1, to achieve the reset of the pawl; 2, give the pawl a pressure to the direction of the screw, so that the threaded part of the pawl can always keep meshing with the screw (except when manually pulling).

One side of the pawl is provided with a toggle member, which is controlled by a reset block, and the reset block is an L-shaped block, the user can dial the toggle piece on the pawl through the reset block, so as to realize the rotation of the pawl.

The reset block is fixed with a reset pull rope. In actual use, the staff will stand above the wire and remotely control the position of the reset block through the reset pull rope to make the pawl rotate.

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5. Conclusion

Reviewing the development of ground clip, its development is only in the continuous improvement of the shape, there is no significant improvement in the mode of operation, so that the installation of short-circuit grounding wire is still a power transmission line outage maintenance constraints "bottleneck" [5]. In this paper, a kind of electric self-locking ground clip is proposed, and the related design and research are carried out. Its goal is to solve a series of problems in the existing ground clip, such as unreliable connection, difficult assembly and disassembly.

The electric self-locking grounding clamp designed in this paper realizes the movement of the fixture by driving the motor, thus holding the wire and reducing the working intensity of the staff. And because the transmission part and screw are threaded connection, realize the self-locking function, thus improving the safety.

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