

Development of auxiliary device for transformer lead production

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Abstract

This paper for the transformer lead field production difficult problem, develop a transformer lead production auxiliary device, has the advantages of convenient operation, safe and reliable, realize the transformer lead bending and straightening function, improve the transformer lead construction technology, successfully solve the safety hidden danger, waste, lead arrangement is not beautiful.

Keywords

OCR, field operation, photo management.

1. Introduction

From the perspective of the management process and construction status of distribution network project of State Grid Corporation, the main problems of distribution network project are:

(1)The construction is very casual and not highly standardized. Mainly reflected in the production and installation process, especially the connection line direction, curvature and other randomness, and directly related to the installation skills level of the construction personnel.

(2) The material intensification and civilized construction management is difficult to implement in place. Mainly reflected in the construction of random materials, the accumulation of more surplus materials, the construction site sporadic materials and tools are more, stacked messy.



Figure 1 The sporadic and messy materials on the construction site

The site installation and production process is more, the work efficiency is not high. Mainly reflected in the construction site installation and production of more machinery and tools and facilities required, coupled with the construction site environment is poor, low work efficiency, the operation time is difficult to control.

In recent years, the government has vigorously carried out the construction of beautiful countryside, the process can not only change the rural style and health environment, but also

rectify all kinds of resources, form characteristic mountain villages, improve the quality of life of rural residents, and create a harmonious local culture. State Grid Corporation of China also put forward the construction idea of high-quality platform areas. Centering on the construction of beautiful countryside, it has completed the transformation of platform areas[1], line "up to down", and residential meter box transformation and other projects, so that the power lines and equipment are more beautiful and orderly.

Most of the current dry-type power transformers, whether SC series or SG series, mostly use D-shaped three-phase connection for high voltage. Due to the relatively small current of high-voltage lead, from the perspective of material saving and beautiful appearance, and in order to ensure the insulation distance, it is necessary to consider the strength of lead and the skin effect of high-voltage current. It is most reasonable to choose copper tube as high-voltage lead. However, there is no jumper problem in d-connection, In this way, it is necessary to bend the high-voltage copper pipe lead. Moreover, due to the large models and different capacities of distribution transformers, the space dimensions of low-voltage coils are different, the positions of the first and last outgoing ends to be bent are also different, and the thickness and number of wires to be bent are also different. The existing lead bending tooling is difficult to meet the use needs of transformers with different models and capacities, and there are problems of low practicability and universality. There is no specific method or tool for the traditional copper tube lead production. Most of them rely on workers' independent operation, simple tool production, low precision, inaccurate angle and poor quality assurance. In the lead bending operation, it is required to manually bend the lead for many times, and then place it on the fixture for glue wrapping operation. Because the lead forming is complex and is greatly affected by the change of product shape, the lead position is offset after many times of lead bending, resulting in many defective products in the subsequent glue wrapping process. Therefore, a set of auxiliary device for making transformer leads in this project has the advantages of convenient operation, safety and reliability, realizes the bending and straightening function of transformer leads, improves the construction technology of transformer leads, and successfully solves the problems of potential safety hazards, waste, unsightly lead arrangement and so on.

2. Lead line bending process requirements

(1) Lead line preparation

Lead preparation with the manufacturer's process, including the work content is also quite different, in short, all kinds of lead parts before the device, the work can be called lead preparation. Its main work is: parts processing, according to the drawing size, wrapping, pre-welding, holding adjacent leads and forming insulation parts assembly preparation.

(2) Lead wire welding

Lead line welding mainly refers to the welding between the winding head and the lead line or the welding between the winding outlet line. Before welding, wrap the root of the wire with a wet asbestos rope. When welding, the neutral flame is generally used, and the ratio of oxygen and acetylene should be moderate. When welding, to avoid the lead root being burnt and affect its insulation performance.

(3) Insulation dressing and winding of the lead line

After the welding, the welding part shall be covered with metal shielding paper or wrinkle paper, and then equipped with partition, groove, forming insulation parts, etc. The insulation paper is made of 100% wood fiber-based sulfate cellulose, with no impurities and foreign bodies, and should have sufficient electrical and mechanical strength.

1) Bandaging of lead insulation connection: the insulation thickness of each side of the lead above 110kV is 10mm or 20mm respectively. If the lead insulation is not once, conical insulation connection will be used to increase the creepage distance and avoid flash discharge, and the

cone length is 7 ~ 10 times the insulation thickness. The thickness of each side of the lead of class 6-10kV is 2-6 mm. If thin insulation is selected, the cone cannot be formed, it should be overlapped with a length > 50mm. If selected insulation of 4 ~ 6mm thick phenolic paper pipe should also form a conical connection.

2) Insulation dressing at the lead welding: the lead welding dressing generally has the same requirements as the insulation binding, but to remove welding slag, oxides, carbon black impurities, etc., file the sharp corners and burrs, check the welding quality, and take a layer of bread white cloth on the appearance. The thickness is > 1mm in 10kV, 35kV > 2mm, 110kV according to total dressing insulation requirements; length > 10mm in 10kV, 35kV > 30mm and 110kV > 80mm. As for 220kV class, the high pressure lead welding, in addition to its insulation should be conical connection, but also need gold attribute electric screen and rounded treatment.

(4) Arrangement and fastening of the leads

After the lead insulation dressing, a comprehensive arrangement shall be carried out to keep all lead arranged neat and beautiful, clamped and tightened reliable, and the cleaning condition and lead insulation distance shall be comprehensively checked.

3. Design and implementation of the device structure

(1) Overall structure

For the high-voltage lead of transformer copper tube, a transformer lead making tool is provided, which is a tool for bending the lead by matching a group of moving rollers with circular arc grooves and fixed rollers. The group of rollers is fixed on a handle support, in which the distance between the moving roller and the fixed roller is adjusted by the adjusting screw rod of the moving roller and matched with a positioning pin. The tool is a tool that can complete the lead bending work well by using the combination of moving (fixed) rollers and reasonable adjustment. This tool has the advantages of simple manufacture, reasonable structure and strong universality, and can overcome many problems brought by traditional Ding tools. The developed transformer lead making tool includes base, handle support, fixed roller, moving roller and adjusting screw rod; The wheel surfaces of the fixed roller and the moving roller are provided with arc grooves; The fixed roller is fixed on the base; The front end of the handle support is movably connected with the center of the fixed roller through a shaft, and the middle part of the handle support is provided with an adjusting long hole along the axial direction; The moving roller is installed on the adjusting long hole through the fixed support; The adjusting screw rod is installed at the tail end of the handle support. The front end of the adjusting screw rod faces the moving roller and is connected with the fixed support to make the moving roller close to or away from the fixed roller during the rotation of the adjusting screw rod; The upper part of the fixed roller is provided with a groove for positioning the lead on the fixed roller. The device is equipped with an electric button for easy operation. It is equipped with a 12V 100 a lithium battery, which can be used for on-site operation (see Figure 1).



Fig. 1 Physical drawing of the device

(2) Bend module

The bending module mainly comprises a first bending component fixedly connected with the driving wheel and a second bending component fixedly connected with the driven wheel. The first bending component and the second bending component are respectively provided with a first forming groove and a second forming groove matched with the electric wire. The first forming groove and the second forming groove are used to lean the electric wire against the forming block and drive the electric wire to rotate along the contour of the two arc surfaces of the forming block; And a clamping mechanism, the clamping mechanism is arranged facing the flat front side of the forming block, which comprises a cylinder fixed above the base and a clamping block connected with the telescopic rod of the cylinder, and the clamping block is provided with a clamping groove matched with the electric wire. As shown in Figure 2-3, the plug can be replaced according to the size of the cable.

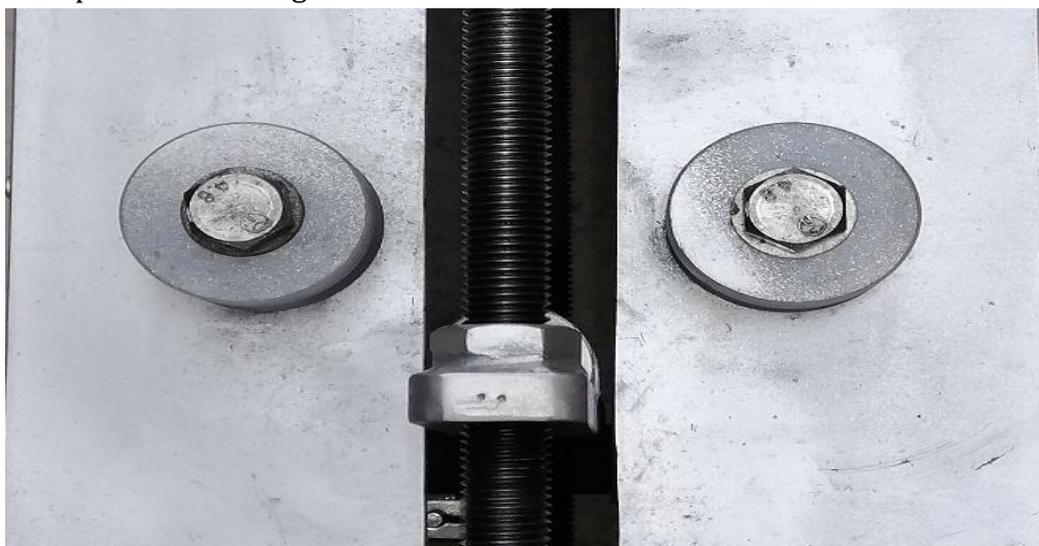


Figure 2 Replacement Top

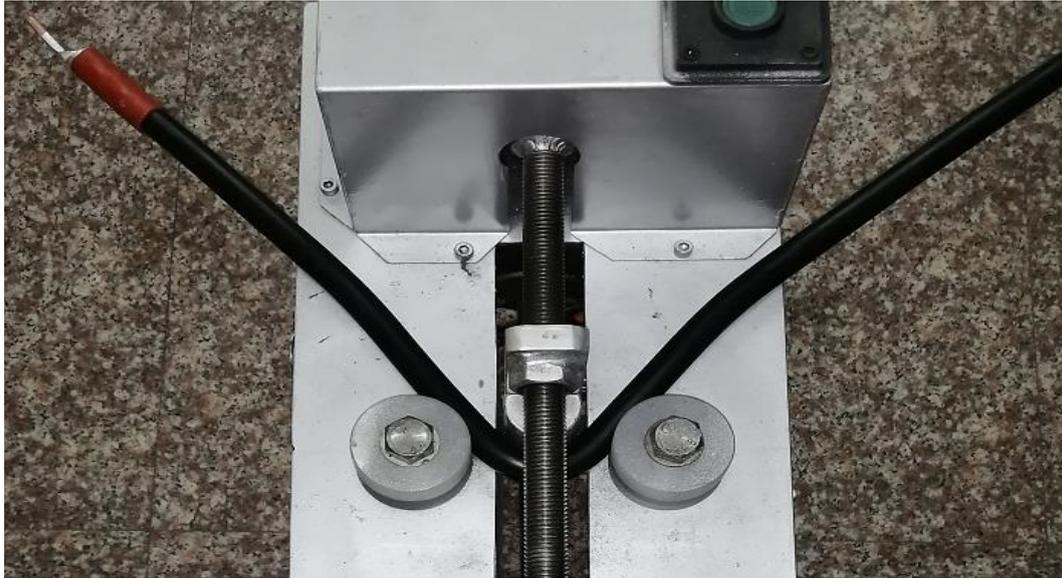


Figure 3 Bending effect

(3) The leveling module

In the process of field operation, it is often necessary to press the bent lead straight. Therefore, the flattening module is designed, which is mainly composed of upper and lower plate components. The first plate is fixed, and the other plate is connected with the telescopic rod. The air cylinder drives the plate to move and press the lead straight, as shown in the following figure.

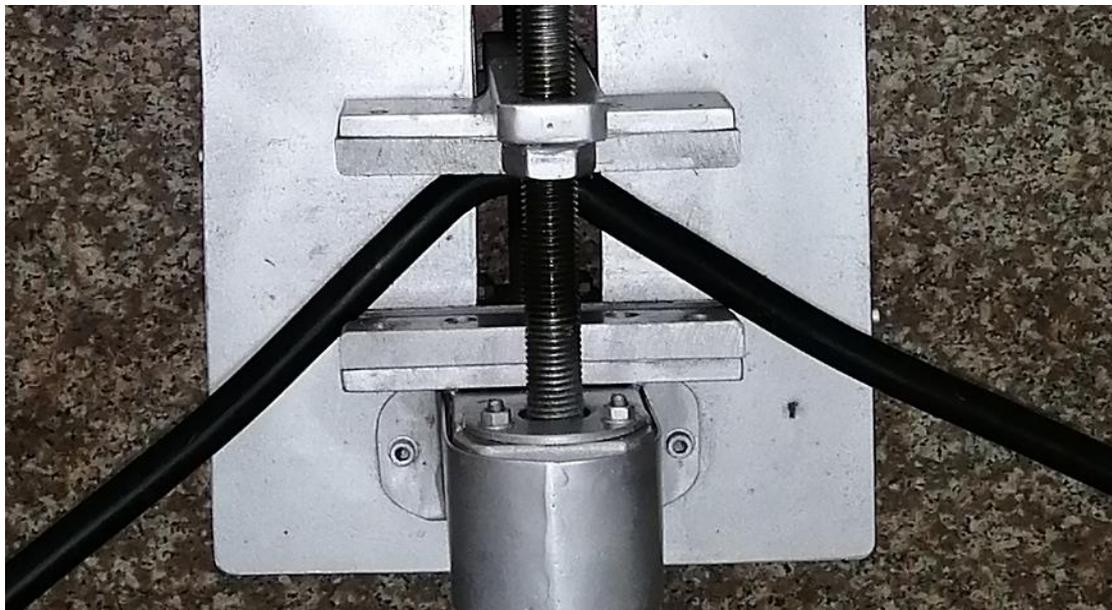


Figure 4 The leveling module

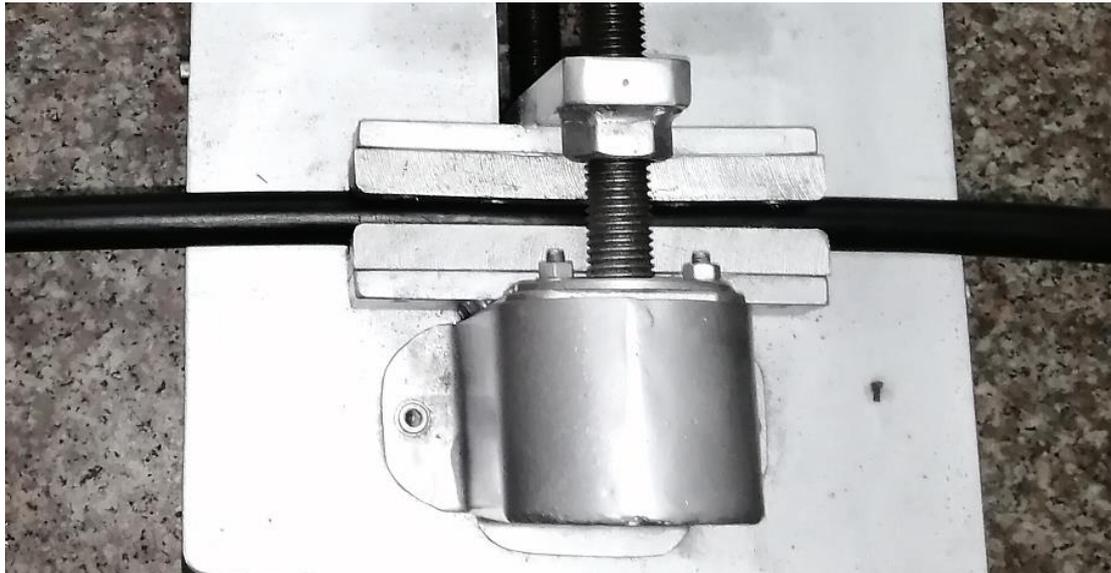


Figure 5 Pressure leveling effect

4. Conclusion

After the integrated lead making auxiliary device is applied to on-site operation, the product quality is stable, the operation is simple, and the efficiency is more than ten times higher than that of ordinary molds, creating great economic benefits. The machine has small structure, can be expanded and has a wide range of application. It has little damage to materials during bending and high yield. After continuous improvement, the stator and rotor can be adjusted appropriately. It is suitable for folding wire and plate with small size, realizing the bending of all kinds of thin-walled and plate parts, creating greater value for the company, providing new ideas and directions for the later design of molds and fixtures, and has broad prospects for achievement transformation.

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