Spacer for Double Bundle in Phase Conductor of Transmission Line Based on Cross Universal Joint Structure

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Abstract. This research belongs to the field of transmission line, that is, the double bundle in-phase conductor spacer of transmission line based on cross universal joint structure. The utility model comprises a spacing rod, two ends of the spacing rod are provided with wire clamps, and the spacing rod and the wire clamp are connected by a cross universal joint, that is, one end of the spacing rod is provided with a fork, the fork is movably connected with two opposite axes of the cross shaft, the back end of the wire clamp is provided with a wire clamp fork, and the fork of the wire clamp is movably connected with another two opposite axes of the cross shaft. The utility model is to replace the ball joint structure of the existing double bundle conductor in the same phase spacer with the cross shaft universal joint structure, so as to increase the allowable range of movement of the spacer, avoid the fracture due to the force beyond the range, and meet the requirements for the installation and use of the double bundle conductor in the same phase of the transmission line. The structure is simple and reasonable, and the use is safe and reliable, which solves the problem that the spacer of the in-phase conductor of the original double bundle conductor of the transmission line is easy to break.

1. Introduction
In the existing technology, it is a special industry in electric power production. Due to the different equipment conditions in different regions, various problems are often encountered. The use of stereotyped tools produced by manufacturers on some equipment is greatly restricted, especially on some equipment, which can not be used at all and can not carry out routine maintenance. Therefore, some heavy and heavy maintenance measures have to be taken during on-site operation Complicated soil method for operation, which not only increases the intensity and difficulty of operation, but also is not conducive to safety production.

In the existing transmission technology, the spacer is a kind of hardware which is installed on the bundled conductors and fixed the spacing between the bundled conductors to prevent the conductors from whipping each other and suppress the breeze vibration and sub span oscillation. One spacer is installed in the middle of the span, and one spacer is installed 50-60m apart. Compared with the vibration amplitude of the conductor without spacer, the vibration amplitude of the conductor with spacer is reduced by 50% for the conductor with two bundle, 87% for the conductor with four bundle and 90% for the conductor with eight bundle. The same phase spacer of double bundle conductor of transmission line adopts ball joint structure, which has small range of motion, When the swing amplitude difference between the two wires is too large, the force on the root of the ball joint structure exceeds the range of motion, and the force is large at this time. With the increase of operation time, the
fracture will occur, and the supporting effect will be lost. When the load increases, the double wires will whip, causing wire damage.[1-5]

2. Design scheme
The purpose of this study is to improve the structure of the ball head universal joint at both ends of the same phase spacer of the original transmission line double bundle conductor, increase the range of motion of the universal joint, and prevent the conductor whip damage caused by the rupture of the ball root of the spacer ball head universal joint when the swing amplitude difference between the two conductors is too large.[5-7]

The technical solution adopted by the double split in-phase conductor spacer of transmission line based on the cross universal joint structure is that it consists of a spacer bar, with wire clamps at both ends of the spacer bar, and the spacer bar and the wire clamp are connected by the cross universal joint, that is, one end of the spacer bar is provided with a fork head, which is movably connected with the two opposite axes of the cross shaft, and the rear end of the wire clamp head is provided with a wire clamp fork. The fork head is movably connected with the other two shafts of the cross shaft.[8-10]

The advantages of double bundle conductor spacer based on cross universal joint structure include two aspects. One is to replace the ball head universal joint structure of the existing double bundle conductor in the same phase spacer with the cross shaft universal joint structure, so as to increase the allowable range of movement of the spacer and avoid the fracture due to the excessive force, so as to meet the requirements of the installation and use of the double bundle conductor in the same phase of the transmission line. The other is that its structure is simple and reasonable, and its use is safe and reliable, which solves the problem that the spacer of in-phase conductor of the original double bundle conductor of transmission line is easy to break.[11-12]

3. Implementation plan

![Structure diagram](image)

As shown in Figure 1 and Figure 2, the names of the parts are as follows: 1 is the spacer, 2 is the line clamp, 3 is the fork, 4 is the cross shaft relative to the two axes, 5 is the line clamp fork, 6 is the cross shaft relative to the other two axes.
Refer to figure 1 and Figure 2. The double split in-phase conductor spacer of transmission line based on cross universal joint structure is characterized in that it includes a spacer bar, two ends of the spacer bar are equipped with wire clamps, and the spacer bar is connected with the wire clamp by cross universal joint, that is, one end of the spacer bar is equipped with fork head, the fork head is movably connected with the two opposite axes of the cross shaft, and the rear end of the wire clamp is equipped with wire clamp fork head. The fork head is movably connected with the other two shafts of the cross shaft.

When two in-phase conductors in double bundle conductor line swing with different amplitudes, the relative distance between the conductors is ensured, and the range of motion of each sub conductor is also increased, so as to prevent the rupture of the spacer of ball joint.

When the conductor vibrates in the breeze, the conductor spacer studied in this paper can effectively absorb the energy generated by the breeze, so as to suppress the vibration effect of the conductor and reduce the damage of the conductor.

When the wind galloping occurs, the conductor spacer studied in this paper can effectively adjust the galloping amplitude compared with the general conductor spacer. Through the design of cross universal joint connection, the mechanical strength of conductor spacer is improved, and the safe and stable operation of conductor is ensured.

4. Conclusion

Due to the different tower structures of power towers in different regions, the applicable tools are also different, and even the tower forms applicable in a region are different, which brings great waste and trouble to power production. Therefore, it has a very large promotion space to realize the universal tools in domestic power production.

By replacing the ball joint structure of the existing double bundle conductor in the same phase spacer with the cross joint structure, the allowable range of motion of the spacer is increased, so as to avoid the fracture due to the force beyond the range. The equipment can effectively meet the standard of installation and use of double bundled conductors in the same phase of transmission line. Based on the cross universal joint structure, the spacer of double bundle in-phase conductor of transmission line is simple and reasonable in structure, safe and reliable in use, which solves the problem that the spacer of double bundle in-phase conductor of original transmission line is easy to break. It is believed that it will be effectively applied in the field of power transmission in the future.[13-15]
Acknowledgments
Here, I would like to express my thanks to the leaders of State Grid Tonghua Power Supply Company for their support to our scientific research work. At the same time, thanks to all the members of our team.

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