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PRACTICAL APPLICATION OF A HIGH VOLTAGE POWER SUPPLY CABLE FASTENING

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ABSTRACT

High flame retardant drag chain power sheathed cables are used for equipment power supply, and in the outdoor environment, the power transmission power cable needs to be fixed to the wall, usually along the industrial route. The cable bridge moves, extends more frequently, the power supply cable needs to be fixed with a cable sling device, because there is no such special sling device on the market, so the use of the existing card fixing method leads to the cable often squeezed and damaged insulation layer cable failure power outage. This article addresses this problem and proposes for feasible countermeasures.

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Introduction.

Take the coal mines of surrounding enterprises as an example, a total of 10 electric shovels and 2 water tanks, through six sets of 5000kVA 35/6.3kV mobile substations, the voltage is reduced to 6.3kV, and the mining drag-type flame-retardant rubber cable ($3\times50+2\times25+1\times25mm^2$) is used to supply power to the power equipment at the mining site. Power supply cables need to cross production and transport roads. Cable bridges are placed on both sides of the road, with a height of 13 meters and a road width of 18 meters, which can be extended to a height of 10 meters, thus ensuring the normal passage of the largest production truck 830E vehicle. According to the production plan, the coal mine shovel is often moves to different locations for operation, and the cable power supply mode needs to be re-planned and a reasonable power supply mode should be formulated. However, in order to effectively improve the power supply quality and shorten the power supply radius at the actual production site, the cable bridge needs to be re-extended again for the cable across the production road.

1. Existing problems.

The cable bridge is composed of an anti-tipping mobile cement pouring base, a 13-meter-high hollow steel pipe, a fixed pulley above and below, Φ13 steel wire rope, and a cable sling device, the cable sling device is mainly used to fix the mine drag rubber cable that needs to be overhead, and the other end of the wire rope uses a command vehicle to lift the cable, so that the cable can be lifted to a height of more than 10 meters. It takes more than 30 minutes to lift the cable bridge each time, and the cable sling device used today uses two steel plates to clamp the cable with 4 sets of bolts to fix it. At present, the cable sling device mainly has the following problems:

1. 1 Low work efficiency

When fixing the cable, three people need to work for 30 minutes. Especially in the cold of winter, the workers work outdoors with great labor intensity, longer working time, and inconvenient to use. When fixing the cable, the operator needs to use a movable wrench to tighten each screw, and the strength of each operator is not uniform when the bolt is tightened, which has a certain risk of cable clamping. Cable sling devices are used outdoors, and after wind and rain erosion, bolts are easy to rust and work efficiency is greatly reduces.

1.2 Damage to cable insulation

The cable sling device compresses the cable for a long time, and the cable directly contacts the sharp cut of the edge of the steel plate during the bending process, resulting in different level of damages to the cable, light damage to the outer skin, heavy damage to the cable insulation layer resulting in single-phase ground fault.

1.3 Prone to safety accidents

If the personnel are next to the cable bridge, at this time, the cable sling device damages the cable insulation layer and causes a single-phase ground fault, which is easy to cause the occurrence of electric shock accidents for personnel.

1.4 Large economic expenditure

Mining drag-on flame retardant rubber cable is expensive, and cold repair is required after failure, which is expensive.

In summary, there are many problems in the use of cable sling devices, such as large damage to cables, weak safety performance, and uneconomical.

2. Countermeasures and solutions

Through further research on the cable, the use performance of the cable and the field environment correction, by further improving the cable sling device according to the size, characteristics and environmental factors of the cable, so as to maximize the work efficiency and protect the cable from the influence of external forces, can ensure the normal use of the cable and extend the service life of the cable, and can greatly improve the work efficiency and reduce the personnel labor. Taking the $3\times50+2\times25+1\times25mm^2$ and $3\times120+2\times50+1\times35mm^2$ mining dragged flame retardant rubber sheathed cables commonly used in coal mine stopes as an example, the outer diameter of the first cable is 57.8mm, and the outer diameter of the second cable is 77mm. According to the use of the cable need to specially develop the cable sling device of the two cables for two cables, considering that in the actual use process, the stope cable bridge is almost once every two days in the work, and the cable bridge is universal, the model of the erection cable cannot be fixed, so the cost saving needs to be further integrated in terms of production consideration.

In the daily cable laying, often fixed pulley on the ground, the cable through the fixed pulley to drag can protect the cable at the corner to protect the cable from damage, according to this principle, the new cable sling device can be made into a 4D semi-circle, greatly protect the cable from damage. And taking into account the ambient temperature, the maximum ambient temperature can reach +40℃ in summer and -40℃ in winter. The strength of the cable sling device can ensure that the maximum cable force meets the requirements in this environment, considering that the rigid material is more fragile in cold weather and easy to crack, the new cable sling device is required to make higher strength and thicker material.

However, after the material is thick, the weight of the new cable sling device itself is larger, which is 4 times the weight of the existing cable sling device, and the labor intensity of personnel is greater and it is not easy to use in winter. In order to reduce the weight, it can be considered the use of aluminum as the main material of the cable sling device, aluminum has good formability, weld ability,

relatively simple production, relatively high strength, easy to process, corrosion resistance, good oxidation resistance, low cost characteristics, but at a lower temperature strength attenuation is large, finally considered the use of aluminum alloy material. Aluminum alloy material has a small density, close to 2.7 high, about 1/3 of iron, higher strength, after a certain degree of cold working can strengthen the basic strength, easy to process, after adding certain alloying elements, can obtain good casting performance of cast aluminum alloy. However, in order to ensure the strength of the new cable sling device, welding must not occur, and it needs to be integrally molded and cast, so that greater strength can be obtained.

Assuming that the operators are working in this environment, the labor intensity of less personnel should be considered, and the new cable sling device should be considered as simple as possible to minimize the labor intensity of personnel. So how can you achieve a way that one person can fix the cable? This needs to consider the fixing of the cable to be easy to operate, the original cable sling device with two steel plates to clamp the cable, fixed with bolts, which requires at least 3 operators to complete normally, and need to tighten bolts, that reduces the efficiency, high strength of operators, and after fixing a long time of use bolts are easy to rust, disassembly is difficult, often need to use bolt loosening agent to remove it, rust serious in the removal of bolts may occur, cable fall has the possibility of causing personal injury. In order to solve these problems, the new cable sling device uses the principle of reaction force to clamp the cable by the weight of the cable itself, and the heavier the cable itself, the greater the force, and only one operator is required to complete the fixed installation of the cable in the operation, which greatly reduces the number of operators, and it only takes 10 seconds to complete through on-site trials.

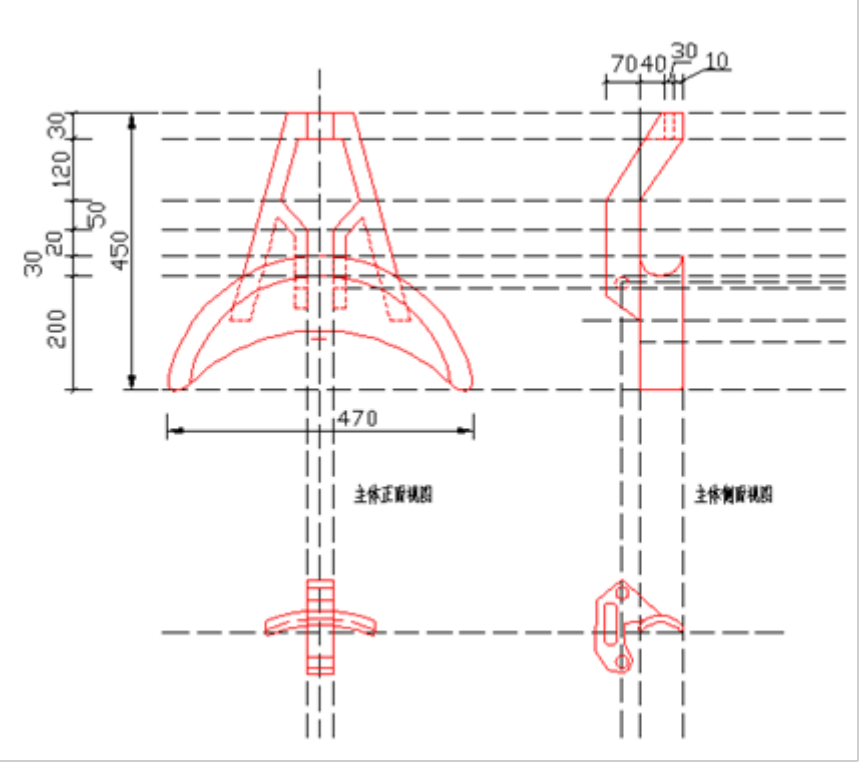

Fig. 1. Design drawing of new cable sling device

Fig. 2. Side and front view of the finished product

Fig. 3. Finished product use effect.

3. Use effect and promotion value.

The original cable sling device requires at least 3 operators to jointly carry out fastening operations when used, and it takes 20~30 minutes to work on the card cable alone. By using this invention and innovation of the new cable sling device, one person can complete this work in 10 seconds, which greatly saves labor, improves work efficiency, and protects the cable from damage. For example, extending a cable bridge 150 times a year can save about 150 power outages × 0.33 hours = 50 hours (2.4 days), according to the depreciation cost of about 20,000 yuan a day of coal mine shovel, it can save about 50,000 yuan per year, and the use of a new cable sling device can reduce 2 operators, reduce labor and reduce wage expenses.

The new cable sling device is suitable for the power supply operation of overhead cables that all kinds of enterprises need. Through experiments, the effect is good and the safety is high after the use of power supply operation in the coal mine, and the coal mine has been replaced with this new cable sling device, which has good promotion values.

Conclusions.

Improve the cable sling device, so as to maximize the work efficiency and protect the cable from the influence of external forces, can ensure the normal use of the cable and extend the service life of the cable, and can greatly improve the work efficiency and reduce the personnel labor.

Use an electric winch instead of a vehicle to lift the cable bridge to ensure the safety of the cable bridge erection process and avoid personnel injury and equipment damage. The innovation of this research lies in starting from the actual production of enterprises, combined with the theoretical research ability of school teachers, and striving to solve the practical problems encountered in the application of electric power technology in enterprises, forming a virtuous circle of production, learning and research.

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