

A New Kind of Anti-bending and Anti-deformation Cathode Frame for Electrostatic Precipitators

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Abstract. The present invention discloses a cathode frame of an electrostatic precipitator, comprising a rectangular frame composed of four horizontal bars and five vertical bars; The horizontal and vertical bars are perpendicular to each other and located in the same plane, and four horizontal bars are arranged parallel to each other, while five vertical bars are arranged parallel to each other; Four horizontal bars divide the longitudinal length of the rectangular box into three equal parts, five vertical bars divide the transverse length of the rectangular box into 2:1:1:2, and one of the vertical bars is located on the vertical centerline of the rectangular box; The upper section of the two outermost vertical rods on the rectangular frame is a reinforced vertical rod, and there are two horizontal through-holes on the reinforced vertical rod for installing the cathode frame support. The cathode frame of the electrostatic precipitator has a simple structure and convenient assembly, which can effectively prevent the cathode frame of the electrostatic precipitator from bending, deformation, or even sliding and collapsing from the overall cathode support, greatly improving the safety and stability of the operation of the electrostatic precipitator.

Keywords: Electrostatic precipitator; Cathode frame; Anti bending deformation; Anti slip collapse; high safety and stability.

1. Introduction

The present invention relates to a cathode system of an electrostatic precipitator, in particular to a cathode frame of an electrostatic precipitator, particularly suitable for electrostatic precipitators with large electric field spans.

Electrostatic precipitator is an environmentally friendly equipment that uses a direct current high-voltage electric field to purify dust in industrial flue gas. The electrode that is usually connected to the negative electrode of high-voltage direct current is called the corona electrode (also known as the cathode), and the electrode that collects dust is called the precipitation electrode or anode (the anode must be grounded). The cathode frame is a very important component of the cathode system of an electrostatic precipitator, with several corona electrode wires installed on it. Usually, the cathode frame is made of seamless steel pipes into a rectangular frame, which is welded with four horizontal and four vertical rods; The left and right sides of the rectangular frame have a support on each shoulder, and they are installed on the cathode bracket with buckles.

However, the cathode frame of larger electrostatic precipitators has a relatively large self weight, and after a long operating time, a certain amount of dust will accumulate on the horizontal and vertical poles of the cathode frame, as well as on the corona electrode line. Especially when the cathode rapping device is not working properly, the dust accumulation on the corona electrode line is more severe, which is commonly known as "cathode hypertrophy" phenomenon, resulting in the total weight of the entire cathode frame becoming larger and larger, The entire cathode frame is completely supported by the two upper supports on its left and right frames, which will cause all the crossbars of the cathode frame to bend downwards, forming a concave upward arch shape. That is, the deformation of the crossbar in the middle is the most severe, causing lateral deformation,

changing the distance between the corona electrode line and the anode plate, and reducing the electric field operating voltage of the electrostatic precipitator, greatly reducing the dust removal efficiency. In severe cases, electric field short circuit faults occur, The high-voltage control cabinet switch trips, and the electrostatic precipitator completely loses its function; If the situation is particularly serious, it may lead to major accidents such as the overall cathode frame of the electrostatic precipitator slipping and collapsing from the cathode support.

Therefore, there is an urgent need to provide an electrostatic precipitator cathode frame that can effectively prevent the cathode frame of the electrostatic precipitator from bending, deformation, or even sliding and collapsing from the overall cathode support, and improve the operational safety and stability of the electrostatic precipitator.

2. Content of the invention

The purpose of the present invention is to provide a cathode frame for an electrostatic precipitator. The cathode frame of the electrostatic precipitator has a simple structure, is easy to assemble, and can effectively prevent the cathode frame of the electrostatic precipitator from bending, deformation, or even sliding and collapsing from the overall cathode support, greatly improving the safety and stability of the operation of the electrostatic precipitator.

In order to achieve the above purpose, the present invention provides a cathode frame of an electrostatic precipitator, which includes a rectangular frame composed of four horizontal bars and five vertical bars; The horizontal and vertical bars are perpendicular to each other and located in the same plane, and four horizontal bars are arranged parallel to each other, while five vertical bars are arranged parallel to each other; Among them, four horizontal bars divide the longitudinal length of the rectangular box into three equal parts, five vertical bars divide the transverse length of the rectangular box into 2:1:1:2, and one of the vertical bars is located on the vertical centerline of the rectangular box; The upper section of the two outermost vertical rods on the rectangular frame is a reinforced vertical rod, and there are two horizontal through-holes on the reinforced vertical rod for installing the cathode frame support.

Preferably, there is an arc-shaped reinforcing rod located above the crossbar at the top of the rectangular frame. The arc-shaped reinforcing rod is in the same plane as the rectangular frame and protrudes upwards, and both ends are welded and fixed to the crossbar.

Preferably, there are multiple vertical braces between the arc shaped reinforcement rod and the horizontal bar located at the top of the rectangular frame, which are arranged at equal intervals along the horizontal direction and welded and fixed at both ends with the horizontal bar and arc shaped reinforcement rod.

Preferably, the connection between the two ends of the first to the third cross bar in the top-down direction and the vertical bar is provided with a slant support, and the two ends of the slant support are respectively welded on the adjacent cross bar and the vertical bar.

Preferably, both ends of the fourth horizontal bar in the top-down direction form a 45 ° chamfer at the connection between the two outermost vertical bars.

Preferably, the horizontal and vertical poles are made of seamless steel pipes of the same model. Preferably, the intersection of the horizontal and vertical poles is connected by welding.

Preferably, the reinforced vertical pole is made of double steel pipes welded in parallel.

Preferably, the length of the reinforced vertical bar is greater than 1/3 of the length of the vertical bar and extends from the top of the rectangular frame to the lower position of the second slant support in the top-down direction.

According to the above technical solution, the present invention adds a vertical rod on the vertical centerline of the rectangular frame, which is mainly used to increase the anti deformation ability of the cathode frame in the middle. The phenomenon of downward deformation and bending is most likely to occur in the middle position of the cathode frame. Although the arc shaped reinforcing rod and vertical support at the top of the rectangular frame have a significant

improvement in the anti deformation ability of the entire cathode frame, considering the large span of the electric field, Once the amount of dust accumulation on the corona electrode line in the middle of the cathode frame is too large, deformation may also occur. In order to comprehensively improve the anti deformation ability of the entire cathode frame, further strengthening treatment is needed for the middle position of the cathode frame. Moreover, this structure of the present invention is also beneficial for maintenance personnel to repair the fault point in the middle of the electric field after the electric dust collector stops operating; At the same time, the upper parts of the vertical bars of the left and right frames of the rectangular frame are additionally provided with a reinforced vertical bar structure with two pipes welded in parallel (both pipes are provided with two horizontal through holes for installing the cathode frame support), and its length is required to be greater than one third of the total longitudinal length of the rectangular frame, and it is respectively extended to the lower end of the second slant support from top to bottom and welded with the slant support, This is because the weight of the entire cathode frame and its reinforced structure, as well as the total weight of all corona electrode lines and their accumulated dust, are supported by these two points. Traditional single tube structures often experience deformation and bending of the support due to excessive weight. The dual tube structure provided by the present invention not only greatly increases the mechanical strength at the support point of the cathode frame, but also ensures that one-third of the area of the upper half of the rectangular frame is sturdy, It also increases the deformation resistance of the second crossbar and even the entire cathode frame.

The other features and advantages of the present invention will be explained in detail in the subsequent specific implementation sections.

Illustrated Figures:

The accompanying drawings are intended to provide a further understanding of the present invention and form a part of the specification. Together with the specific embodiments below, they are used to explain the present invention, but do not constitute a limitation of the present invention. In the attached figure:

Figure 1 is a structural schematic diagram of the cathode frame of an electrostatic precipitator according to an embodiment provided by the present invention;

Figure 2 is a cross-sectional view of A-A in Figure 1. Description of Symbols

- 1- Arc shaped reinforcing rod
- 2- Vertical support
- 3-rectangular frame
- 4-horizontal bar
- 5-vertical pole
- 6-neneneba diagonal brace
- 7- Strengthen the vertical pole.

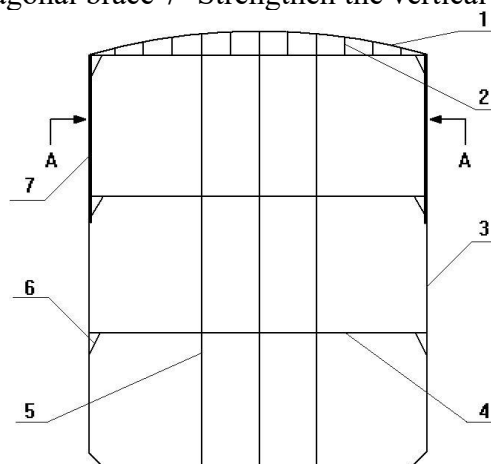


Figure 1 The structural schematic diagram of the cathode frame of an electrostatic precipitator according to an embodiment provided by the present invention



A — A

Figure 2 The cross-sectional view of A-A in Figure 1

3. Specific embodiments

The following is a detailed explanation of the specific implementation method of the present invention in conjunction with the accompanying drawings. It should be understood that the specific embodiments described here are only intended to illustrate and explain the present invention and are not intended to limit it.

In the present invention, without any contrary explanation, the directional words such as "up, down, left, right, inside, outside, far, near" included in the term only represent the direction of the term in conventional use, or are commonly understood by those skilled in the art, and should not be regarded as limiting the term.

Referring to Figure 1, the present invention provides a cathode frame for an electrostatic precipitator, comprising a rectangular frame 3 composed of four horizontal rods 4 and five vertical rods 5; Horizontal bar 4 and vertical bar 5 are perpendicular to each other and located in the same plane, and four horizontal bars 4 are arranged parallel to each other, while five vertical bars 5 are arranged parallel to each other; Among them, four horizontal bars 4 divide the longitudinal length of rectangular box 3 into three equal parts, five vertical bars 5 divide the transverse length of rectangular box 3 into 2:1:1:2, and one vertical bar 5 is located on the vertical centerline of rectangular box 3; The upper section of the two outermost vertical rods 5 on rectangular frame 3 is a reinforced vertical rod 7, and there are two horizontal through-holes on the reinforced vertical rod 7 for installing the support of the cathode frame, as shown in Figure 2.

Through the above technical solution, the present invention adds a vertical rod on the vertical centerline of the rectangular frame, whose main function is to increase the anti deformation ability of the middle of the cathode frame, because the middle position of the cathode frame is most prone to downward deformation and bending. Although the arc shaped reinforcing rod and vertical support at the top of the rectangular frame have a significant improvement in the anti deformation ability of the entire cathode frame, considering the large span of the electric field, Once the amount of dust accumulation on the corona electrode line in the middle of the cathode frame is too large, deformation may also occur. In order to comprehensively improve the anti deformation ability of the entire cathode frame, further strengthening treatment is needed for the middle position of the cathode frame. Moreover, this structure of the present invention is also beneficial for maintenance personnel to repair the fault point in the middle of the electric field after the electric dust collector stops operating; At the same time, the upper parts of the vertical bars of the left and right frames of the rectangular frame are additionally provided with a reinforced vertical bar structure with two pipes welded in parallel (both pipes are provided with two horizontal through holes for installing the cathode frame support), and its length is required to be greater than one third of the total longitudinal length of the rectangular frame, and it is respectively extended to the lower end of the second slant support from top to bottom and welded with the slant support, This is because the weight of the entire cathode frame and its reinforced structure, as well as the total weight of all

corona electrode lines and their accumulated dust, are supported by these two points. Traditional single tube structures often experience deformation and bending of the support due to excessive weight. The dual tube structure provided by the present invention not only greatly increases the mechanical strength at the support point of the cathode frame, but also ensures that one-third of the area of the upper half of the rectangular frame is sturdy, It also increases the deformation resistance of the second crossbar and even the entire cathode frame.

In this embodiment, in order to improve the tensile bending capacity of the rectangular frame 3, it is preferable to have an arc-shaped reinforcing rod 1 above the crossbar 4 located at the top of the rectangular frame 3. The arc-shaped reinforcing rod 1 is in the same plane as the rectangular frame 3 and protrudes upwards, with both ends welded and fixed to the crossbar 4. Furthermore, it is preferable to have multiple vertical braces 2 arranged at equal intervals along the horizontal direction between the arc-shaped reinforcing rod 1 and the horizontal rod 4 located at the top of the rectangular frame 3, and the two ends are respectively welded and fixed to the horizontal rod 4 and the arc-shaped reinforcing rod 1. In this way, the vertical brace 2 is welded with the arc-shaped reinforcement rod 1 and the top crossbar 4 to form a whole, forming a highly rigid structure with strong tensile bending capacity, especially for this upward convex arc-shaped structure. At the same time, an upward slant support 6 is added at the lower end of the connection between the top three cross bars 4 of the rectangular frame, that is, the first, second and third cross bars 4 counted from top to bottom, and the left and right frames of the rectangular frame 3, respectively. Because once the traditional cathode frame is bent and deformed, the above connection is often desoldered and torn, and in order to avoid the above situation, Preferably, the connection between the two ends of the first to the third cross bar 4 and the vertical bar 5 in the top-down direction is provided with a slant support 6, and the two ends of the slant support 6 are respectively welded on the adjacent cross bar 4 and the vertical bar 5.

After the above technical scheme is adopted, the slant support 6 forms a stable triangular structure with the connected cross bar 4 and vertical bar 5, which further strengthens the anti deformation ability of the cathode frame, especially the corresponding cross bar 4, and improves the stress of the welding points between the connected cross bar 4 and vertical bar 5.

In order to optimize the connection method of the cathode frame of the electrostatic precipitator, make it beautiful and symmetrical, and increase the distance between the cathode frame and the surrounding grounding body to avoid tip discharge, it is preferable to form a 45 ° chamfer at the connection between the two ends of the fourth horizontal rod 4 in the top-down direction and the two outermost vertical rods 5.

The cathode frame and its reinforcing structure in the present invention are all made of steel pipes of the same specification, wherein the reinforcing vertical rod 7 is welded by two single pipes of the same specification in parallel, without protruding parts in the electric field, maintaining the same distance from the anode, and not causing close discharge, which does not affect the power transmission of the entire electric field. The present invention also does not change the length and installation method of the corona electrode line, and is convenient for installation and debugging.

The preferred embodiments of the present invention are described in detail above in conjunction with the accompanying drawings. However, the present invention is not limited to the specific details of the aforementioned embodiments. Within the scope of the technical concept of the present invention, multiple simple variations can be made to the technical solution of the present invention, all of which fall within the scope of protection of the present invention.

It should also be noted that the various specific technical features described in the above specific embodiments can be combined in any suitable way without contradiction. In order to avoid unnecessary repetition, the present invention will not separately explain various possible combination methods.

In addition, various different embodiments of the present invention can also be combined arbitrarily, as long as they do not violate the ideas of the present invention, they should also be considered as the disclosed content of the present invention.

4. Application

The electrostatic precipitator in a certain factory has a long-term problem of being unable to work properly or completely stopping operation due to the ordinary cathode frame of the electrostatic precipitator, which seriously affects the normal operation of the factory production and thus also affects the economic benefits of the factory. A few years ago, after the factory adopted the technology disclosed in this article, there had never been an electric field short circuit accident caused by the cathode frame. The cathode frame has been running continuously for over a few years and is still operating very stably.

5. Conclusion

The practice has proved that the cathode frame of electrostatic precipitators in this article overcomes the problems of the existing technology that seriously affect the stable operation of electrostatic precipitators, such as bending and deformation, or even sliding and collapsing from the overall cathode support. The new kind of anti-bending and anti-deformation cathode frame for electrostatic precipitators disclosed in this article greatly improving the safety and stability of the operation of the electrostatic precipitator, and it has higher practical value and promotion value.

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