

## SELF-LOCKING DEVICE FOR ANTI-FALLING RAIL

### TECHNICAL FIELD

[01] The present disclosure relates to the field of power transmission auxiliary equipment, and specifically relates to a self-locking device for an anti-falling rail.

### BACKGROUND ART

[02] In recent years, with continuous deepening and perfection of power grid construction and continuous improvement of the power transmission voltage level, more and more mileages of overhead power transmission lines are constructed, and the maintenance work of the lines becomes more and more burdensome. Because the operation safety of the power transmission lines is extremely important to the social development, regular maintenance of power transmission towers is a powerful guarantee for normal and stable operation of the power transmission lines. The anti-falling device is a safety protection measure for tower overhead working personnel in climbing, moving and operating processes, and particularly can protect the operating personnel when the operating personnel fall.

[03] An existing tower anti-falling device generally mainly comprises an anti-falling rail and a self-locking device, wherein the self-locking device is used in cooperation with the rigid anti-falling rail. At present, the section form of the rigid anti-falling rail mounted on a tower is mainly T-shaped (namely as shown in FIG. 1), due to the problems of machining, mounting and the like, the phenomena of clamping stagnation and the like are prone to occurring in the using process of an on-site anti-falling device, and the using effect of the anti-falling device is affected. Meanwhile, an existing self-locking device is complex in structure, tedious to machine and inconvenient to disassemble, and the self-locking device cannot be disassembled from the middle of the guide rail and can only be disassembled from the end of the guide rail.

### SUMMARY

[04] To solve the problem that an existing anti-falling self-locking device is inconvenient to disassemble, a self-locking device for an anti-falling rail is provided, the self-locking device for an anti-falling rail is matched with the anti-falling rail in size, and a guide structure in contact with the surface of the anti-falling rail adopts rolling friction to reduce the friction force between the self-locking device and the anti-falling rail, so that the trafficability of the self-locking device on the anti-falling rail is improved; the self-locking device adopts an openable structure and can be opened from the middle part of the non-end part of the anti-falling rail, so that when the self-locking device is stuck on the anti-falling rail, the self-locking device is conveniently taken down from the anti-falling rail and is mounted by crossing the part of the anti-falling rail with the stuck phenomenon.

[05] To achieve the purpose, the present disclosure provides the following scheme:

[06] The self-locking device for an anti-falling rail provided by the present disclosure comprises a housing, a spring, a rotary rod and a first connection shaft, a through groove for inserting and connecting an anti-falling rail is formed in the housing, the

housing comprises a fixed-side main body and an open-side main body, the fixed-side main body is detachably connected to the open-side main body, two ends of the first connection shaft are connected to the fixed-side main body and the open-side main body respectively, one end of the rotary rod is located inside the housing, the other end of the rotary rod is located outside the housing, and the spring may make the rotary rod rotate about the first connection shaft, and allows one end of the rotary rod to abut against the front surface of a wing board of the anti-falling rail.

**[07]** Preferably, the fixed-side main body comprises a first fixed plate and a second fixed plate which are sequentially connected, the first fixed plate is parallel to the open-side main body, and the second fixed plate is located between the first fixed plate and the open-side main body.

**[08]** Preferably, a spring mounting ladder hole is formed in the second fixed plate, a spring baffle plate is fixed in one end of the spring mounting ladder hole, one end of the spring is connected to the spring baffle plate, and the other end of the spring is connected to the rotary rod.

**[09]** Preferably, the first connection shaft comprises an arch section, a large-diameter section and a small-diameter section which are sequentially connected, the outer diameter of the arch section is larger than that of the large-diameter section, and the outer diameter of the large-diameter section is larger than that of the small-diameter section.

**[10]** Preferably, the arch section and the large-diameter section of the first connection shaft are in interference fit with the first fixed plate, and the small-diameter section of the first connection shaft passes through the rotary rod.

**[11]** Preferably, the open-side main body is connected to a stop screw, the end of the small-diameter section is inserted and connected into the open-side main body, and the stop screw can prevent the fixed-side main body from being separated from the open-side main body.

**[12]** Preferably, a limiting groove is formed in the end of the small-diameter section, and when the tail end of the stop screw is inserted into the limiting groove of the first connection shaft, the fixed-side main body and the open-side main body are connected and fixed; and when the tail end of the stop screw is separated from the limiting groove of the first connection shaft, the fixed-side main body and the open-side main body can be separated.

**[13]** Preferably, the self-locking device for an anti-falling rail also comprises a second connection shaft, the second connection shaft is parallel to the first connection shaft, the second connection shaft and the first connection shaft are mirror images of each other, and the two ends of the second connection shaft are connected to the fixed-side main body and the open-side main body respectively.

**[14]** Preferably, the self-locking device for an anti-falling rail also comprises inner side guide wheels, outer side guide wheels and side face guide wheels, the inner side guide wheels can roll on the front surface of the wing board of the anti-falling rail, the outer side guide wheels can roll on the back surface of the wind board of the anti-falling rail, and the side face guide wheels can roll on the side face of the wing board of the anti-falling rail.

[15] Preferably, the outer side guide wheels are of cone frustum-shaped structures, the outer diameters of the small-diameter sections of the outer side guide wheels are larger than the outer diameters of the inner side guide wheels, each outer side guide wheel comprises an inner wheel body and a wear-resistant material layer, each inner wheel body sleeves the corresponding wear-resistant material layer, and each wear-resistant material layer is connected to the corresponding inner wheel body through an outer side baffle plate and a sunk screw.

[16] Compared with the prior art, the present disclosure has the following beneficial technical effects:

[17] Firstly, according to the self-locking device for an anti-falling rail provided by the present disclosure, the self-locking device for an anti-falling rail is detachable, so that the self-locking device for an anti-falling rail can be detached conveniently when the self-locking device cannot pass through the middle position of the guide rail, and the self-locking device crosses the obstacle position and continues to be mounted and used.

[18] Secondly, the self-locking device for an anti-falling rail provided by the present disclosure solves the problem that the self-locking device is easy to clamp and stagnate when being used on a power transmission line anti-falling rail.

[19] Thirdly, the self-locking device for an anti-falling rail provided by the present disclosure solves the problem that the self-locking device is high in integral machining difficulty.

[20] Fourthly, the self-locking device for an anti-falling rail provided by the present disclosure is simple and practicable, and operates smoothly on the power transmission line anti-falling rail.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

[21] To describe the technical scheme in the embodiments of the present disclosure or in the prior art more clearly, the following briefly introduces the attached figures required for describing the embodiments. Apparently, the attached figures in the following description show merely some embodiments of the present disclosure, and those skilled in the art may still derive other attached figures from these attached figures without creative efforts.

[22] FIG. 1 is a schematic diagram of an existing anti-falling rail;

[23] FIG. 2 is a top solid schematic diagram of a self-locking device for an anti-falling rail in the present disclosure;

[24] FIG. 3 is a bottom solid schematic diagram of the self-locking device for an anti-falling rail in the present disclosure;

[25] FIG. 4 is a use-state schematic diagram of the self-locking device for an anti-falling rail in the present disclosure;

[26] FIG. 5 is a section view of the self-locking device for an anti-falling rail in the present disclosure;

[27] FIG. 6 is a solid schematic diagram of a fixed-side main body;

[28] FIG. 7 is a solid section view of the fixed-side main body;

[29] FIG. 8 is a solid schematic diagram of an open-side main body;

[30] FIG. 9 is a schematic diagram that the fixed-side main body and the open-side

main body are in a connected state;

[31] FIG. 10 is a schematic diagram that the fixed-side main body and the open-side main body are in a separated state;

[32] FIG. 11 is a front view of a first connection shaft;

[33] FIG. 12 is a connected schematic diagram of the first connection shaft, the open-side main body and a stop screw;

[34] FIG. 13 is a structural schematic diagram of an outer side guide wheel; and

[35] FIG. 14 is a schematic diagram of a rotary rod.

[36] Reference signs in drawings: 1, housing; 2, spring; 3, rotary rod; 4, first connection shaft; 5, spring baffle plate; 6, stop screw; 7, second connection shaft; 8, inner side guide wheel; 9, outer side guide wheel; 10, side face guide wheel; 11, fixed-side main body; 12, open-side main body; 13, first fixed plate; 14, second fixed plate; 15, through groove;

[37] 20, anti-falling rail; 21, front surface of wing board; 22, back surface of wing board; 23, side face of wing board;

[38] 41, arch section; 42, large-diameter section; 43, small-diameter section; 44, limiting groove;

[39] 91, inner wheel body; 92, wear-resistant material layer; 93, outer side baffle plate; and 94, sunk screw.

## DETAILED DESCRIPTION

[40] The following clearly and completely describes the technical scheme in the embodiments of the present disclosure with reference to the attached figures in the embodiments of the present disclosure. Apparently, the described embodiments are merely a part rather than all of the embodiments of the present disclosure. All other embodiments obtained by those skilled in the art based on the embodiments of the present disclosure without creative efforts shall fall within the protection scope of the present disclosure.

[41] The present disclosure aims to provide a self-locking device for an anti-falling rail to solve the problems in the prior art.

[42] To make the foregoing objective, features and advantages of the present disclosure clearer and more comprehensible, the present disclosure is further described in detail below with reference to the attached figures and specific embodiments.

[43] The self-locking device for an anti-falling rail provided by the embodiment, as shown in FIG. 1 to FIG. 5, comprises a housing 1, a spring 2, a rotary rod 3 and a first connection shaft 4, a through groove 15 for inserting and connecting an anti-falling rail 20 is formed in the housing 1, the housing 1 comprises a fixed-side main body 11 and an open-side main body 12, the fixed-side main body 11 is detachably connected to the open-side main body 12, two ends of the first connection shaft 4 are connected to the fixed-side main body 11 and the open-side main body 12 respectively, one end of the rotary rod 3 is located inside the housing 1, the other end of the rotary rod 3 is located outside the housing 1, the first connection shaft 4 passes through the rotary rod 3, and the spring 2 may make the rotary rod 3 rotate about the first connection shaft 4, and allows one end of the rotary rod 3 to abut against the front surface 21 of a wing board of

the anti-falling rail 20.

**[44]** The self-locking device for an anti-falling rail is suitable for anti-falling rails 20 with T-shaped or I-shaped cross sections. For example, the cross section of the anti-falling rail 20 is T-shaped, the anti-falling rail 20 comprises a wing board and a bottom board, the wing board comprises a front surface 21 of the wing board, a back surface 22 of the wing board and a side face 23 of the wing board. The self-locking device for an anti-falling rail 20 is normally in a self-locking state, namely, when the self-locking device for an anti-falling rail is mounted on the anti-falling rail 20, the spring 2 provides pressure to the rotary rod 3, and one end of the rotary rod 3 always abuts against the front surface 21 of the wing board of the anti-falling rail 20, so that the self-locking device for an anti-falling rail cannot move relative to the anti-falling rail 20.

**[45]** In the embodiment, as shown in FIG. 6 to FIG. 8, for convenience of mounting and machining, the fixed-side main body 11 is detachably connected to the open-side main body 12. The housing 1 is of a split structure, the cross section of the housing 1 is concave, the fixed-side main body 11 comprises a first fixed plate 13 and a second fixed plate 14 which are sequentially connected, the first fixed plate 13 is parallel to the open-side main body 12, and the second fixed plate 14 is located between the first fixed plate 13 and the open-side main body 12, namely, the first fixed plate 13, the second fixed plate 14 and the open-side main body 12 are sequentially connected. One end of the first connection shaft 4 is connected to the first fixed plate 13, and the other end of the first connection shaft 4 is connected to the open-side main body 12.

**[46]** In the embodiment, a spring mounting ladder hole is formed in the second fixed plate 14, a spring baffle plate 5 is fixed in one end of the spring mounting ladder hole, one end of the spring 2 is connected to the spring baffle plate 5 in an abutting mode, and the other end of the spring 2 is connected to the rotary rod 3 in the abutting mode. The first connection shaft 4 comprises an arch section 41, a large-diameter section 42 and a small-diameter section 43 which are sequentially connected, the outer diameter of the arch section 41 is larger than that of the large-diameter section 42, and the outer diameter of the large-diameter section 42 is larger than that of the small-diameter section 43.

**[47]** Wherein, the cross section of the arch section 41 is an arch, and the cross section of the large-diameter section 42 and the cross section of the small-diameter section 43 are both circles. The arch section 41 and the large-diameter section 42 of the first connection shaft 4 are in interference fit with the first fixed plate 13, and the small-diameter section 43 of the first connection shaft 4 passes through the rotary rod 3.

**[48]** In the embodiment, in order to conveniently achieve detachable connection between the fixed-side main body 11 and the open-side main body 12, the open-side main body 12 is connected to the stop screw 6, namely, the stop screw 6 is in threaded connection with the open-side main body 12. The end of the small-diameter section 43 is inserted and connected into the open-side main body 12, and the stop screw 6 can prevent the fixed-side main body 11 from being separated from the open-side main body 12.

**[49]** Specifically, as shown in FIG. 10, FIG. 11 and FIG. 12, a limiting groove 44 is formed in the end of the small-diameter section 43, and when the tail end of the stop

screw 6 is inserted into the limiting groove 44 of the first connection shaft 4, the fixed-side main body 11 and the open-side main body 12 are connected and fixed, namely, the fixed-side main body 11 and the open-side main body 12 cannot be separated, as shown in FIG. 9, FIG. 11 and FIG. 12; and when the tail end of the stop screw 6 is separated from the limiting groove 44 of the first connection shaft 4, the fixed-side main body 11 and the open-side main body 12 can be separated, namely, the fixed-side main body 11 and the open-side main body 12 are in a separated state.

**[50]** When the fixed-side main body 11 and the open-side main body 12 are in the separated state as shown in FIG. 10, the anti-falling rail 20 can be conveniently inserted and connected into the through groove 15 of the self-locking device for an anti-falling rail; and when the fixed-side main body 11 and the open-side main body 12 are in a connected state as shown in FIG. 9, the self-locking device for an anti-falling rail can be prevented from being separated from the anti-falling rail 20.

**[51]** In the embodiment, the self-locking device for an anti-falling rail also comprises a second connection shaft 7, the second connection shaft 7 is parallel to the first connection shaft 4, the second connection shaft 7 and the first connection shaft 4 are mirror images of each other, and the two ends of the second connection shaft 7 are connected to the fixed-side main body 11 and the open-side main body 12 respectively. The connection type of the second connection shaft 7 and the fixed-side main body 11 is identical to that of the first connection shaft 4 and the fixed-side main body 11, and the connection type of the second connection shaft 7 and the open-side main body 12 is identical to that of the first connection shaft 4 and the open-side main body 12. Relative rotation can be prevented from being generated when the fixed-side main body 11 and the open-side main body 12 are in the separated state by arranging the second connection shaft 7.

**[52]** In the embodiment, the self-locking device for an anti-falling rail also comprises inner side guide wheels 8, outer side guide wheels 9 and side face guide wheels 10, the inner side guide wheels 8 can roll on the front surface 21 of the wing board of the anti-falling rail 20, the outer side guide wheels 9 can roll on the back surface 22 of the wing board of the anti-falling rail 20, and the side face guide wheels 10 can roll on the side face 23 of the wing board of the anti-falling rail 20.

**[53]** In the embodiment, as shown in FIG. 13, the outer side guide wheels 9 are of cone frustum-shaped structures, the outer diameters of the small-diameter sections of the outer side guide wheels 9 are larger than the outer diameters of the inner side guide wheels 8, each outer side guide wheel 9 comprises an inner wheel body 91 and a wear-resistant material layer 92, each inner wheel body 91 sleeves the corresponding wear-resistant material layer 92, and each wear-resistant material layer 92 is detachably connected to the corresponding inner wheel body 91 through an outer side baffle plate 93 and a sunk screw 94.

**[54]** The self-locking device for an anti-falling rail is further described below.

**[55]** The fixed-side main body 11 and the open-side main body 12 are structural main bodies of the self-locking device, an asymmetric structure is arranged between the fixed-side main body 11 and the open-side main body 12, the fixed-side main body 11 and the open-side main body 12 serve as a mounting structure and a bearing structure of

other structures, the split structure is convenient to machine compared with an integrated structure, and the machining cost can be effectively reduced. The spring 2 is fixed in the fixed-side main body 11 and can keep the pressing force of one end of the rotary rod 3 on the front surface 21 of the wing board of the anti-falling rail 20, a ladder mounting hole for mounting the spring is formed in the fixed-side main body 11, the spring baffle plate 5 of the self-locking device is mounted at the ladder mounting hole, the spring baffle plate 5 is in interference fit with the ladder mounting hole to limit the spring 2, and the machining cost can be reduced. The other end of the rotary rod 3 is connected to a U-shaped ring. The pressing force of one end of the rotary rod 3 on the front surface 21 of the wing board of the anti-falling rail 20 can be relieved by pulling the U-shaped ring, and at the moment, the self-locking device for an anti-falling rail can move relative to the anti-falling rail 20.

**[56]** The open-side main body 12 may move at a distance of 8 mm to 13 mm relative to the fixed-side main body 11, namely, the open-side main body 12 becomes a state as shown in FIG. 10 after moving to the right by 8 mm to 13 mm in FIG. 9. After the self-locking device for an anti-falling rail is opened, the outer side guide wheels 9 can move towards one side and be separated from the back surface 22 of the wing board of the anti-falling rail, and the self-locking device for an anti-falling rail can be detached from or mounted on the anti-falling rail 20. In order to ensure that the open-side main body 12 does not rotate when moving relative to the fixed-side main body 11, the two connection shafts are adopted to connect the fixed-side main body and the connected-side main body, the movement guiding effect is achieved, and meanwhile, the overall strength of the machine body is enhanced.

**[57]** Rolling friction is adopted when the inner side guide wheels 8, the outer side guide wheels 9 and the side face guide wheels 10 move relative to the anti-falling rail 20, the inner side guide wheels 8, the outer side guide wheels 9 and the side face guide wheels 10 all adopt the structural form of guide wheels and center shafts, the guide wheels can rotate around the center shafts, proper gaps are reserved between the contact faces of the guide wheels and the rail, and on the basis of ensuring the safety of the self-locking device, the trafficability of the self-locking device on the rail is improved.

**[58]** The inner side guide wheels 8, together with the outer side guide wheels 9, have a clamping effect on the wing board of the anti-falling rail 20; when the self-locking device is in an unlocked state, the inner side guide wheels 8 make contact with the front surface 21 of the wing board of the anti-falling rail 20 and roll relatively, when falling happens and the self-locking device is in a locked state, the pressing face of the rotary rod 3 generates pressing force on the front surface 21 of the wing board of the rail, and meanwhile, the inner side guide wheels 8 are disengaged from the front surface 21 of the wing board of the rail; and because the inner side guide wheels 8 only have a rolling guide function, and the outer side guide wheels 9 also need to bear impact force generated during falling and limit the position of the self-locking device on the anti-falling rail while having the rolling guide function, the outer diameters of the outer side guide wheels 9 are larger than those of the inner side guide wheels 8, and the outer side guide wheels 9 are two groups more than the inner side guide wheels 8 in number.

**[59]** The outer side guide wheels 9 are cone frustum-shaped and can be better

matched with the shape of the back surface 22 of the wing board of the guide rail, so that the contact area between the outer side guide wheels 9 and the back surface 22 of the wing board of the rail is increased. The outer side guide wheels 9 are easy to wear and need to be replaced frequently when being rubbed with the steel material of the rail, so that the structure is designed to be a structure easy to open and replace. The number of the inner side guide wheels 8 is four, the number of the outer side guide wheels 9 is six, and the number of the side face guide wheels 10 is four.

**[60]** As shown in FIG. 14, through reasonable design of relative positions and shape structures of a rotary center, a load center and the pressing face of the rotary rod 3, the rotary rod 3 can effectively bear falling impact force and has high sensitive locking performance, when an operator falls, human body falling impact load acts on the load center through the U-shaped ring, a rotary block is pulled to rotate around the rotary center, then the pressing face presses the anti-falling rail and is locked on the rail, falling loads are transmitted to the machine body through the rotary block and the connection shafts, the operator is prevented from falling, and the safety of the operator is guaranteed.

**[61]** Several examples are used for illustration of the principles and implementation methods of the present disclosure. The description of the embodiments is used to help illustrate the method and its core principles of the present disclosure. In addition, those skilled in the art can make various modifications in terms of specific embodiments and scope of application in accordance with the teachings of the present disclosure. In conclusion, the content of this specification shall not be construed as a limitation to the present disclosure.

### **WHAT IS CLAIMED IS:**

1. A self-locking device for an anti-falling rail, comprising a housing (1), a spring (2), a rotary rod (3) and a first connection shaft (4), wherein a through groove (15) for inserting and connecting an anti-falling rail (20) is formed in the housing (1), the housing (1) comprises a fixed-side main body (11) and an open-side main body (12), the fixed-side main body (11) is detachably connected to the open-side main body (12), two ends of the first connection shaft (4) are connected to the fixed-side main body (11) and the open-side main body (12) respectively, one end of the rotary rod (3) is located inside the housing (1), the other end of the rotary rod (3) is located outside the housing (1), and the spring (2) may make the rotary rod (3) rotate about the first connection shaft (4), and allows one end of the rotary rod (3) to abut against the front surface (21) of a wing board of the anti-falling rail (20).

2. The self-locking device for an anti-falling rail according to claim 1, wherein the fixed-side main body (11) comprises a first fixed plate (13) and a second fixed plate (14) which are sequentially connected, the first fixed plate (13) is parallel to the open-side main body (12), and the second fixed plate (14) is located between the first fixed plate (13) and the open-side main body (12).

3. The self-locking device for an anti-falling rail according to claim 2, wherein a spring mounting ladder hole is formed in the second fixed plate (14), a spring baffle plate (5) is fixed in one end of the spring mounting ladder hole, one end of the spring (2) is connected to the spring baffle plate (5), and the other end of the spring (2) is connected to the rotary rod (3).

4. The self-locking device for an anti-falling rail according to claim 2, wherein the first connection shaft (4) comprises an arch section (41), a large-diameter section (42) and a small-diameter section (43) which are sequentially connected, the outer diameter of the arch section (41) is larger than that of the large-diameter section (42), and the outer diameter of the large-diameter section (42) is larger than that of the small-diameter section (43).

5. The self-locking device for an anti-falling rail according to claim 4, wherein the arch section (41) and the large-diameter section (42) of the first connection shaft (4) are in interference fit with the first fixed plate (13), and the small-diameter section (43) of the first connection shaft (4) passes through the rotary rod (3).

6. The self-locking device for an anti-falling rail according to claim 5, wherein the open-side main body (12) is connected to a stop screw (6), the end of the small-diameter section (43) is inserted and connected into the open-side main body (12), and the stop screw (6) can prevent the fixed-side main body (11) from being separated from the open-side main body (12).

7. The self-locking device for an anti-falling rail according to claim 6, wherein a limiting groove (44) is formed in the end of the small-diameter section (43), and when the tail end of the stop screw (6) is inserted into the limiting groove (44) of the first connection shaft (4), the fixed-side main body (11) and the open-side main body (12) are connected and fixed; and when the tail end of the stop screw (6) is separated from the limiting groove (44) of the first connection shaft (4), the fixed-side main body (11) and the open-side main body (12) can be separated.

8. The self-locking device for an anti-falling rail according to claim 1, wherein the self-locking device for an anti-falling rail also comprises a second connection shaft (7), the second connection shaft (7) is parallel to the first connection shaft (4), the second connection shaft (7) and the first connection shaft (4) are mirror images of each other, and the two ends of the second connection shaft (7) are connected to the fixed-side main body (11) and the open-side main body (12) respectively.

9. The self-locking device for an anti-falling rail according to claim 1, wherein the self-locking device for an anti-falling rail also comprises inner side guide wheels (8), outer side guide wheels (9) and side face guide wheels (10), the inner side guide wheels (8) can roll on the front surface (21) of the wing board of the anti-falling rail (20), the outer side guide wheels (9) can roll on the back surface (22) of the wind board of the anti-falling rail (20), and the side face guide wheels (10) can roll on the side face (23) of the wing board of the anti-falling rail (20).

10. The self-locking device for an anti-falling rail according to claim 9, wherein the outer side guide wheels (9) are of cone frustum-shaped structures, the outer diameters of the small-diameter sections of the outer side guide wheels (9) are larger than the outer diameters of the inner side guide wheels (8), each outer side guide wheel (9) comprises an inner wheel body (91) and a wear-resistant material layer (92), each inner wheel body (91) sleeves the corresponding wear-resistant material layer (92), and each wear-resistant material layer (92) is connected to the corresponding inner wheel body (91) through an outer side baffle plate (93) and a sunk screw (94).