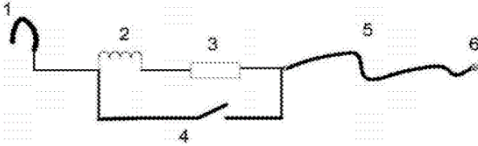


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	1 page of claims 3 pages of description 2 pages of drawings
(54) Title of invention A control device for potential transfer currents and arcs in a UHV live-line operation and a method thereof (57) Abstract The present invention relates to a control device for potential transfer currents and arcs in an ultra-high voltage (UHV) live-line operation and a method thereof. The control device comprises a potential transfer device,	

the potential transfer device comprises a potential transfer circuit, and a control circuit is connected in series with the potential transfer circuit. The potential transfer device transfers potentials with the aid of the potential transfer circuit and restricts the amplitudes of currents and the lengths of arcs during potential transfers with the aid of the control circuit. The technical solution of the present invention eliminates the influence of the amplitudes of potential transfer currents on operators and equipment during potential transfers in a UHV live-line operation, eliminates the influence of too long arcs on the gap insulation performance, and effectively improves the safety of operators.

1. A control device for potential transfer currents and arcs in a UHV live-line operation, the control device comprising a potential transfer device, and the potential transfer device comprising a potential transfer circuit, characterized in that a control circuit is connected in series with the potential transfer circuit, and the potential transfer device transfers potentials with the aid of the potential transfer circuit and restricts the amplitudes of currents and the lengths of arcs during potential transfers with the aid of the control circuit.
2. The control device for potential transfer currents and arcs in a UHV live-line operation according to claim 1, characterized in that the control circuit comprises an inductor and a resistor connected in series.
3. The control device for potential transfer currents and arcs in a UHV live-line operation according to claim 1 or 2, characterized in that the control circuit is provided with a bypass switch and the control circuit goes into the working mode or exits from the working mode, depending on the closed state of the bypass switch.
4. The control device for potential transfer currents and arcs in a UHV live-line operation according to claim 4, characterized in that the potential transfer circuit comprises a clamping mechanism, a connecting device, a plurality of stranded copper wires and a connecting terminal connected in turn, and the control circuit is disposed between the clamping mechanism and the connecting device.
5. The control device for potential transfer currents and arcs in a UHV live-line operation according to claim 4, characterized in that the clamping mechanism comprises a wire clip, a wire clamping structure disposed on the inner side of the wire clip and a lever device disposed on the wire clip, the lever device is connected with the bypass switch, the wire clamping structure clamps a wire under a force after the wire clip contacts the wire, and the force is applied to the bypass switch with the aid of the lever device to close the switch.
6. The control device for potential transfer currents and arcs in a UHV live-line operation according to claim 1, characterized in that the potential transfer device is a potential transfer rod and comprises an insulated operating rod disposed below the control circuit and a handheld terminal disposed below the insulated operating rod.
7. A control method for potential transfer currents and arcs in a UHV live-line operation, characterized in that the method comprises:
a live-line operator carrying the control device to enter a hanging basket or horizontal ladder and connecting the connecting terminal of the potential transfer circuit of the control device to the screening clothes of the live-line operator; the live-line operator moving to a position 0.5 m away from the UHV wire, transferring a potential with the aid of the control device, the wire clamping structure clamping the wire under a force after the wire clip contacts the wire, the force being applied to the bypass switch with the aid of the lever device to close the bypass switch, the

- control circuit exiting from work, and the live-line operator and the wire being equipotentially connected; when exiting from an equipotential, the live-line operator entering the hanging basket or horizontal ladder and pulling away the potential transfer device at a distance of 0.5 m away from the wire to separate the potential
- 5 transfer device from the wire, the bypass switch being opened, the control circuit going into work, and currents and arcs being controlled.

A Control Device for Potential Transfer Currents and Arcs in a UHV Live-Line Operation and a Method Thereof

Technical Field

- 5 [0001] The present invention relates to the field of live-line work, in particular to a control device for potential transfer currents and arcs in a UHV live-line operation and the method thereof.

Background Art

- 10 [0002] Live-line operation is an operation mode in which an overhaul or test operation is performed when power grid equipment does not stop supplying power or the running mode of power grid equipment is not changed, and a live-line operation is of great significance to the safety and reliability of the running of a power grid. For 110 kV or higher-voltage power grid equipment, the equipotential
- 15 operation method is mainly adopted in live-line operations, and the equipotential operation method is simple, safe and highly efficient. The equipotential entry is a critical step to carry out a live-line operation. When an overhaul is performed on 500 kV or lower-voltage power grid equipment, the amplitude of a potential transfer current is low and the arc distance is also short, usually influencing the
- 20 operator and equipment insignificantly. When a live-line operation is performed on a UHV AC or DC line or transformer station (converter station), the amplitude of a potential transfer current is high and the arc distance is long at the time of entry into or exit from an equipotential. In addition, the high-frequency electromagnetic field of the potential transfer current and the strong electric field of a UHV
- 25 influences the measuring equipment and the operator significantly. Therefore, it is very significant for the safety of the operator, equipment and line gap insulation to restrict the current and the arc produced during a potential transfer. The prior potential transfer tools are mainly the prior potential transfer current and arc protection tools, mainly including a current transfer rod. The main function of the
- 30 potential transfer rod is to realize a potential transfer and avoid a current from passing through a human body. The potential transfer rod does not have the capability of restricting potential transfer currents and arcs. Too large a potential current, too long an arc and too large a short-circuited gap exist during the entry or exit of a live-line operator into or from an equipotential, and thus the gap insulation
- 35 strength may drop to cause a discharging accident.

Summary of the Invention

- [0003] The object of the present invention is to provide a control device for potential transfer currents and arcs in a UHV live-line operation and a control method. In combination with the characteristics of operating a potential transfer rod during the entry into and exit from an equipotential, a potential transfer current and arc control circuit is introduced, and arc extinction is realized by restricting the size of a potential transfer current and changing the phase. The control device and method are used to eliminate the influence of the amplitude of a potential transfer current on the operator and equipment during a potential transfer in a UHV live-line operation.
- 5 [0004] To achieve the above-mentioned object, the following technical solution is adopted for the present invention. A control device for potential transfer currents and arcs in a UHV live-line operation is provided, the control device comprises a potential transfer device, and the potential transfer device comprises a potential transfer circuit; a control circuit is connected in series with the potential transfer circuit; the potential transfer device transfers potentials with the aid of the potential transfer circuit and restricts the amplitudes of currents and the lengths of arcs during potential transfers with the aid of the control circuit.
- 10 [0005] The control circuit comprises an inductor and a resistor connected in series.
- [0006] The control circuit is provided with a bypass switch and the control circuit goes into the working mode or exits from the working mode, depending on the closed state of the bypass switch.
- 15 [0007] The potential transfer circuit comprises a clamping mechanism, a connecting device, a plurality of stranded copper wires and a connecting terminal connected in turn, and the control circuit is disposed between the clamping mechanism and the connecting device.
- 20 [0008] The clamping mechanism comprises a wire clip, a wire clamping structure disposed on the inner side of the wire clip and a lever device disposed on the wire clip, the lever device is connected with the bypass switch, the wire clamping structure clamps a wire under a force after the wire clip contacts the wire, and the force is applied to the bypass switch with the aid of the lever device to close the switch.
- 25 [0009] The potential transfer device is a potential transfer rod and comprises an insulated operating rod disposed below the control circuit and a handheld terminal disposed below the insulated operating rod.
- 30 [0010] A control method for potential transfer currents and arcs in a UHV live-line operation comprises: a live-line operator carrying the control device to enter a hanging basket or horizontal ladder and connecting the connecting terminal of the potential transfer circuit of the control device to the screening clothes of the live-
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line operator; the live-line operator moving to a position 0.5 m away from the UHV wire, transferring a potential with the aid of the control device, the wire clamping structure clamping the wire under a force after the wire clip contacts the wire, the force being applied to the bypass switch with the aid of the lever device
5 to close the bypass switch, the control circuit exiting from work, and the live-line operator and the wire being equipotentially connected; when exiting from an equipotential, the live-line operator entering the hanging basket or horizontal ladder and pulling away the potential transfer device at a distance of 0.5 m away from the wire to separate the potential transfer device from the wire, the bypass
10 switch being opened, the control circuit going into work, and currents and arcs being controlled.

[0011] Compared with the closest prior art, the technical solution provided by the present invention has the following advantageous effects:

[0012] 1. In the technical solution of the present invention, a simple circuit
15 consisting of an inductor and a resistor is introduced into the potential transfer rod to control potential transfer currents and arcs. The method is simple and convenient.

[0013] 2. In the technical solution of the present invention, the acting forces of the wire clip and the clamping structure during the entry into and exit from an
20 equipotential are utilized to drive the opening and closing of the bypass switch, and in addition mechanical interlocking is realized, without any additional operation, and the reliability is high.

[0014] 3. In the technical solution of the present invention, a potential transfer current is lowered, and the arc energy and length are reduced.

25 [0015] 4. In the technical solution of the present invention, the risk of currents and arcs damaging an operator is lowered.

[0016] 5. In the technical solution of the present invention, since the arc length is reduced and the short-circuited gap length is reduced, the insulation strength and safety of an operation gap is improved.

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Brief Description of the Drawings

[0017] Fig. 1 shows the control structure for potential transfer currents and arcs in a UHV live-line operation according to one embodiment of the present invention.

[0018] Fig. 2 is a schematic diagram of the control of potential transfer currents
35 and arcs in a UHV live-line operation according to one embodiment of the present invention.

[0019] Fig. 3 shows the structure of the potential transfer rod having the function of controlling potential transfer currents and arcs in a UHV live-line operation according to one embodiment of the present invention.

[0020] The reference numerals in the drawings are: 1 - wire clip, 2 - inductor, 3 - resistor, 4 - bypass switch, 5 - a plurality of stranded copper wires having a transparent protective sleeve, 6 - connecting terminal, 7 - wire clip, 8 - lever device, 9 - potential transfer current and arc control module, 10 - connecting device, 11 - insulated operating rod, 12 - handheld terminal

[0021] 21 - Potential transfer current and arc control module

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Particular Embodiments

[0022] The following further describes in detail the present invention in combination with an embodiment.

[0023] Embodiment 1:

15 [0024] The invention in the present embodiment provides a control device for potential transfer currents and arcs in a UHV live-line operation and a control method. The technical solution eliminates the influence of the amplitudes of potential transfer currents on operators and equipment during potential transfers in a UHV live-line operation, eliminates the influence of too long arcs on the gap
20 insulation performance, and effectively improves the safety of operators. In combination with the characteristics of operating a potential transfer rod during the entry into and exit from an equipotential, a potential transfer current and arc control circuit is introduced, and arc extinction is realized by restricting the size of a potential transfer current and changing the phase.

25 [0025] An inductor 2 and a resistor 3 are connected in series in the potential transfer circuit. As shown in Fig. 1, the bypass switch 4 is in the opened state and the potential transfer and arc control circuit goes into the working mode during an entry into and exit from an equipotential. Under the action of the inductor 2 and the resistor 3, the transient capacitance and current between the operator and the wire
30 are significantly reduced. After the entry into an equipotential, the wire is clamped by the wire clip 1, and a lever device 8 on the wire clip 1 enables the bypass switch 4 to be closed through the leverage, the potential transfer current and arc control circuit consisting of the inductor 2 and the resistor 3 are short-circuited to exit from work, and a good contact and a low inductance of the potential transfer circuit are
35 maintained. The value range of the resistor is 200 ohms to 400 ohms, and the value range of the inductor is 0.1% to 1% of the capacitance of the equivalent capacitor between the operator and the wire.

[0026] The technical principle of the solution is shown in Fig. 2. During an entry into an equipotential, a capacitance exists between the operator and the wire or equipment and a partial capacitance also exists between the operator and the grounding architecture of the ground and the rod tower. During the entry into the equipotential, the capacitance between the human body and equipment is short-circuited by the potential transfer rod and the lead wire. During this process, a current having a great amplitude and an arc will be produced and arcing will repeatedly exist. By introducing an inductor and a resistor into the potential transfer circuit, the amplitude of a current and the energy of an arc can be reduced effectively, and the arc extinction can be promoted.

[0027] Fig. 3 shows a potential transfer rod having the function of controlling a potential transfer current and an arc. A potential transfer current and arc control module 9 is introduced between the wire clip 1 and the connecting device 10 of the potential transfer rod. During the entry into the equipotential, the potential transfer current and arc control module 9 goes into work. The potential transfer current and arc control module is connected to the wire through the wire clip 1 and the wire clamping structure 7 at the time of equipotential. The wire clamping structure 7 closes the bypass switch 4 with the aid of the lever device 8 so that the potential transfer current and arc control module 9 is short-circuited to exit from work and the potential transfer circuit maintains the good electrical conductivity.

[0028] Control method: An operator entering an equipotential carries the potential transfer rod having the function of controlling a potential transfer current and an arc to enter a hanging basket or horizontal ladder, connects the connecting terminal of the potential transfer rod to the screening clothes, gradually moves to a position 0.5 m away from the high-voltage wire, and uses the potential transfer rod shown in Fig. 3 to perform a potential transfer. An arc and a potential transfer current will happen when the wire clip 1 approaches the wire. Because of the current-limiting function of the circuit consisting of the inductor and the resistor, the potential transfer current and the arc are restricted significantly. After the wire clip contacts the wire, the wire clamping structure clamps the wire under the action of a force. The force is applied to the bypass switch 4 with the aid of the lever device 8 to close the bypass switch, the potential transfer current and arc control circuit exits from work, and the operator and the wire are equipotentially connected. At the exit from the equipotential, the operator enters the hanging basket or horizontal ladder, pulls away the potential transfer rod at a distance of 0.5 m away from the wire to separate the potential transfer rod from the wire, the bypass switch 4 is opened, the potential transfer current and arc control circuit goes into work, and currents and arcs are controlled. The acting forces of the wire clip 1 and the clamping structure

during the entry into and exit from an equipotential are utilized to drive the opening and closing of the bypass switch 4, and in addition, mechanical interlocking is realized, without any additional operation, and the reliability is high.

- 5 [0029] It should be noted that the above-mentioned embodiment is only used to describe the technical solution of the present invention, but not to restrict the present invention. Those skilled in the art should understand that modifications or equivalent replacements may be made to the specific implementation mode of the present invention by reference to the above-mentioned embodiment, and any
- 10 modification or equivalent replacement without departing from the spirit and scope of the present invention should fall within the scope of protection of the claims of the present invention, to be approved in the present application.

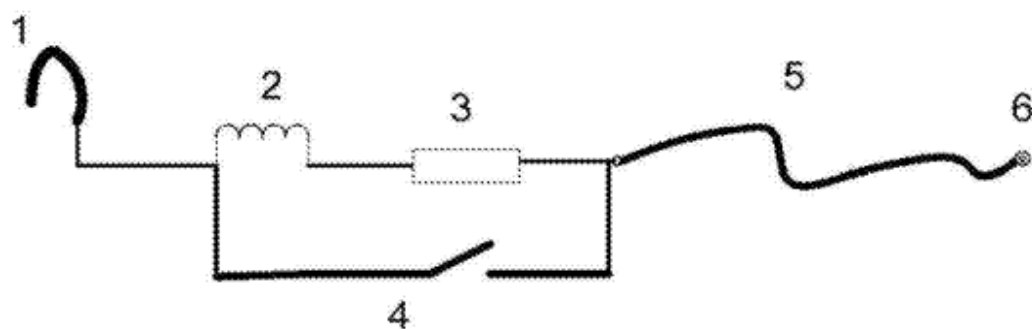


Fig. 1

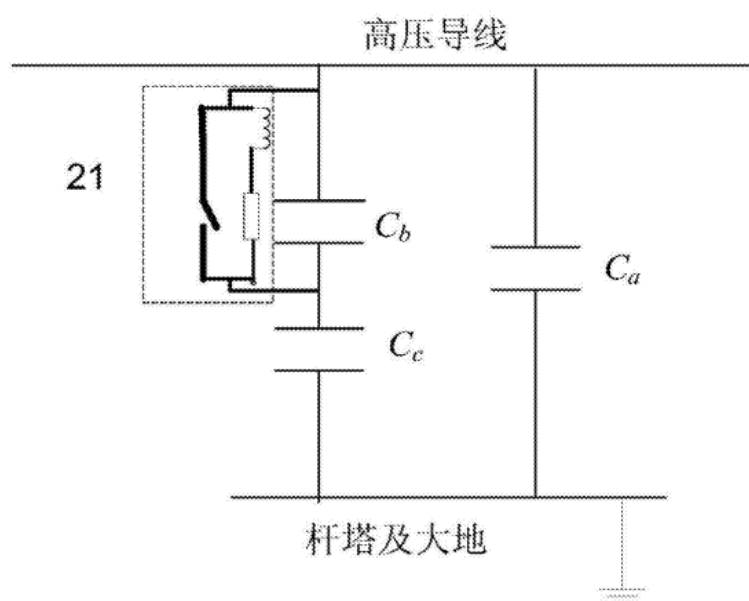


Fig. 2

Source	Translation
高压导线	High-voltage wire
杆塔及大地	Rod tower and ground

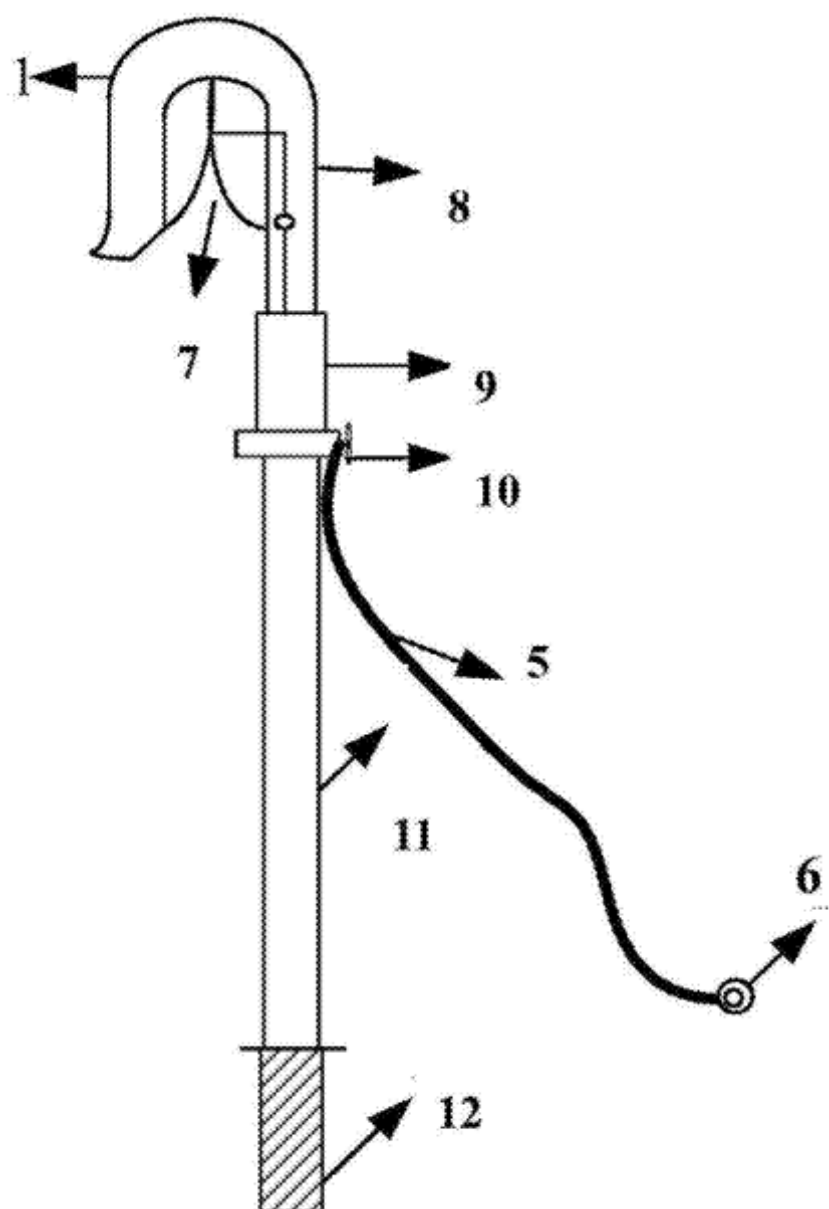


Fig. 3