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A. O. STIGBERG.
THERMAL CUT-OUT AND CIRCUIT CHANGER.
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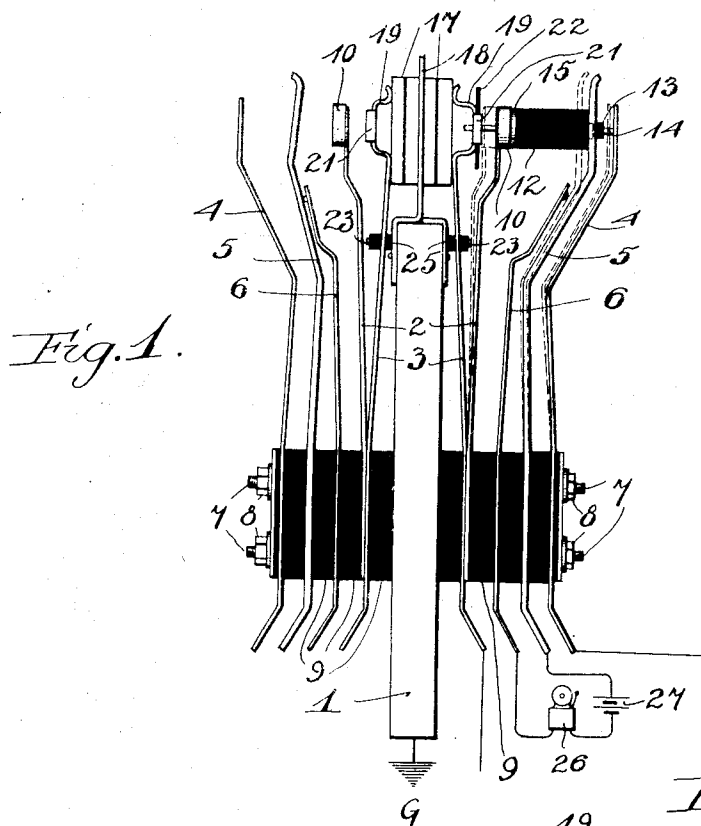


Fig. 2.

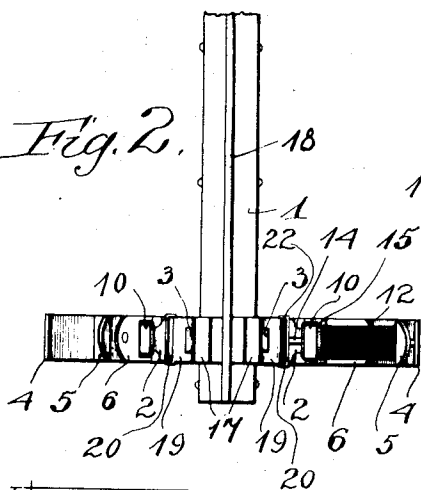
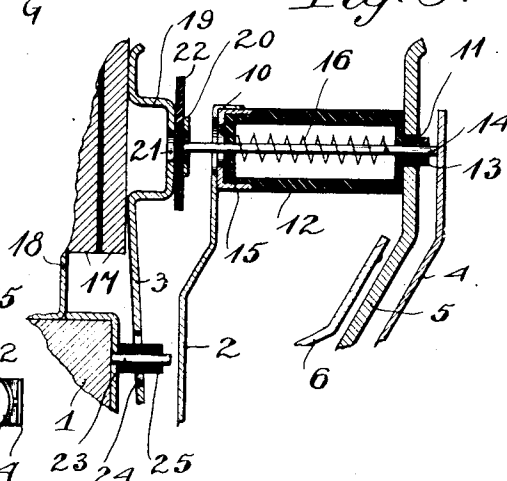


Fig. 3.



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THERMAL CUT-OUT AND CIRCUIT-CHANGER.

No. 833,425.

Specification of Letters Patent.

Patented Oct. 16, 1906.

Application filed June 3, 1904. Serial No. 210,948.

To all whom it may concern:

Be it known that I, ALFRED O. STIGBERG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Thermal Cut-Outs and Circuit-Changers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to thermal cut-outs and circuit-changers, and is of particular adaptation and usefulness in the telephone art for preventing continued and injurious flow of so-called "sneak-currents."

The object of my invention is to provide more efficient and more reliable means for opening the circuit to be protected after a predetermined interval of undue current-flow therethrough and for grounding or discharging said current from the line.

My invention consists of an improved heat-coil associated with improved heat-responsive means for controlling the positions of circuit-changing contact-springs.

The heat-coil consists of a sleeve of insulating material through which passes a heat-conducting rod or stem surrounded by a winding which is connected with one terminal to the stem and with its other terminal to a metallic cap fitting over one end of the sleeve. When the coil is in position, this sleeve engages a line-spring, while the other end of the rod engages the spring connecting with the switchboard apparatus or other apparatus to be protected. An arrester-spring, permanently connected at its end with the line-spring, engages one terminal of a lightning-arrester, the other terminal of which engages a ground-bar, and thus a line may be relieved from lightning or other static charges. This arrester-spring is provided at its upper end with a sleeve or slide having an opening through its walls for the reception of the end of the heat-coil rod, this opening, however, being large enough to prevent contact of the arrester-spring with the rod. A disk of heat-responsive material is adapted to slide through this sleeve and normally blocks the passage of the rod through this opening, and the rod when thus held is pressed at its

other end into contact with the switchboard-spring and against the force of a pressure-spring engaging the switchboard end of the heat-coil. As abnormal current flows through the line and winding of the heat-coil the heat generated by the coil is conducted by the rod to the heat-responsive disk, which becomes softened and allows the pressure-spring to force the rod therethrough, and the rod thereupon becomes disengaged from the switchboard-spring to open the circuit. The line-spring is at the same time carried backward to engage a grounded stem normally disconnected therefrom, and the undue current is then led to ground. The pressure-spring may also engage a contact-spring upon release of the rod to close a local circuit through an annunciator or alarm mechanism.

The heat-coil of my construction may be used continuously without removal from the springs, the parts thereof being at all times relatively stationary. Upon puncture of the heat-responsive disk the coil is pulled outwardly and the heat-responsive disk raised or lowered in the sleeve to present an unpunctured spot to the end of the rod, and the circuit-changer is again in operative condition.

I shall describe my invention more clearly with reference to the accompanying drawings, in which—

Figure 1 shows an elevation view of my invention. Fig. 2 is a top view thereof, and Fig. 3 is an enlarged longitudinal sectional view of the heat-coil and heat-responsive mechanism.

I have shown only a set of opposite springs secured to a ground bar or frame 1, it being understood that any number of spring sets may be connected to the ground-bar in a row. A line-spring 2 and the lightning-arrester spring 3 are provided for each switching mechanism, the lower ends of these springs being permanently conductively connected. A switch-spring 4, a pressure-spring 5, and a contact-spring 6 are also provided, all these springs being assembled and secured at their lower ends to the ground-bar 1 by means of bolts 7 7 and clamping-nuts 8 8, disks 9 9, of insulating material, being interposed between the springs to insulate them from each other and from the ground-frame, the springs 2 and

3, however, as before stated, being in conductive engagement. The line-spring 2 is provided with an annular pocket 10, and the pressure-spring 5 is provided with an opening 11.

5 The heat-coil consists of a cylindrical bushing 12, of insulating material, having closed ends. A bushing 13 extends from the outer end and is adapted to pass through the opening 11. A heat-conducting rod 14 passes

10 through this bushing 13 and through the inner end of the heat-coil, which inner end is provided with a metallic cap 15, insulated from the rod. The heat-coil winding 16 connects with one terminal to this cap and with its

15 other terminal to the heat-conducting rod. The cap 15 when the heat-coil is in position is disposed in the pocket 10, while the bushing 13 passes through the opening 11 on the pressure-spring. A lightning-arrester 17 may

20 be clamped between the upper end of the spring 3 and a plate 18, extending from the ground-bar. The upper end of the spring 3 is bent to form a bridge 19, which carries a sleeve or slot 20. An opening 21 passes

25 through the walls of the sleeve and is adapted for the passage therethrough of the inner end of the heat-conducting rod, this opening, however, being large enough to prevent contact of the rod with the walls thereof. A disk

30 or plate 22, of heat responsive, and preferably insulating, material, is adapted to slide within the sleeve 20 and when in said sleeve serves to block the passage of the heat-conducting rod through the opening 21 and to maintain

35 the other end of the rod in engagement with the switchboard-spring 4 against the force of the pressure-spring 5. A metallic stem 23 extends from the ground-bar through an opening 24 in the lightning-arrester spring

40 3, being surrounded by an insulating-bushing 25 to prevent contact with spring 3. The line-spring 2 is normally out of contact with this grounded stem 23, and the springs 2 and 3 have a tendency normally to separate from

45 each other, whereby spring 3 will clamp the lightning-arrester in place and spring 2 will cause good electrical contact between the pocket 10 and the cap 15 of the heat-coil. When the heat-coil is in place and held by the

50 heat-responsive disk, the pressure of the spring 5 will be transmitted through the rod and heat-responsive disk to the spring 3 to assist in securely clamping the lightning-arrester in place. Upon abnormal current-flow

55 from the line-spring 2 through the heat-coil winding and to the switchboard-spring the heat generated by the winding 16 will be conducted by the rod 14 to the heat-responsive disk 22, which becomes weakened, whereupon the pressure of spring 5 will force the rod

60 through the disk 22, whereupon this rod becomes disengaged from the spring 4 to break the circuit to the switchboard or other apparatus to be protected. At the same time the

65 line-spring 2 will engage the grounded stem or

stud 23, and the undue current will be discharged from the line to ground. A local circuit containing a bell 26 or other alarm or indicating mechanism and a source of current 70 27 may be bridged across the pressure-spring 5 and the contact-spring 6, which upon puncture of the disk 22 will engage each other to close a local circuit and to sound the alarm.

The apparatus may be restored to its normal operative condition by withdrawing the 75 heat-coil a sufficient distance to allow the disk 22 to be raised or lowered to present an unpunctured spot to the end of the heat-conducting rod, and the springs will be returned 80 to their normal positions. As the heat-coil parts are permanently relatively stationary, it is unnecessary to remove the heat-coil from the springs, this becoming necessary only should the heat-coil become mechanically 85 injured or its winding burned or broken. This is a distinguishing and novel feature over prior heat-coils, in which parts were relatively movable upon abnormal current-flow and which it was necessary to remove from the 90 springs to return the parts to their normal position. Depending upon the position of the heat-responsive disk and the strength of the spring 5, this disk may be made of any thickness, and the adjustment in this way 95 can be made very delicate.

Many changes may be made in the arrangement of the switching-springs and in the construction of the heat-coil and heat-responsive parts without departing from the spirit of the 100 invention. I do not wish, therefore, to be limited to the exact arrangement as shown.

I claim as new, however, and desire to secure by Letters Patent—

1. In a thermal cut-out and circuit- 105 changer, the combination with a heat-coil, of a terminal spring connected with one terminal of said coil, a second terminal-spring, heat-responsive means external to said heat-coil for normally retaining the other 110 terminal of said heat-coil in contact with said terminal spring, and means upon abnormal current-flow through said heat-coil for causing said heat-responsive means to release said other terminal from said second 115 terminal spring.

2. In a thermal cut-out, the combination with a heat-coil, of a terminal spring connected with one terminal of said coil, a rod 120 passing through said heat-coil and connected with the other terminal thereof, a second terminal spring, heat-responsive material engaging one end of said rod to maintain the other end thereof in contact with said second terminal spring, and means upon 125 abnormal current-flow through said coil for releasing said rod from said heat-responsive material and from said second terminal spring.

3. In a thermal cut-out, the combination 130

with a heat-coil, of a terminal spring engaging one end of the heat-coil and connected with one terminal thereof, a rod passing through said heat-coil for conducting the heat generated thereby, a second terminal spring, a pressure-spring engaging the other end of said heat-coil, and a heat-responsive mass, said pressure spring serving to firmly press said rod against said heat-responsive mass, the other end of said rod being connected with the other terminal of said heat-coil and with said second contact-spring, abnormal current-flow through said heat-coil causing disengagement of said rod from said heat-responsive mass and from said second terminal spring.

4. In a thermal cut-out, the combination with a heat-coil, of a terminal spring engaging one end thereof and connected with one terminal thereof, a rod passing through said heat-coil connected with the other terminal thereof, a second terminal spring normally engaged by the end of said rod, a plate of heat-responsive material disposed in the path of the other end of said rod, and means upon abnormal current-flow through said heat-coil for causing said rod to pass through said heat-responsive material to disengage said rod from said second terminal spring.

5. In a thermal cut-out, the combination with a heat-coil, of a terminal spring engaging one end thereof and connected with one terminal thereof, a heat-conducting metallic rod passing through said heat-coil and connected with the other terminal thereof, a second terminal spring engaging one end of said rod, a pressure-spring engaging the other end of said heat-coil and tending to disengage said rod from said second terminal spring, and a heat-responsive mass normally disposed before the other end of said rod to prevent said pressure-spring from disengaging said rod from said second terminal spring; abnormal current-flow through said heat-coil causing the release of said rod from said heat-responsive mass and from said second terminal spring.

6. In a thermal cut-out, the combination with a heat-coil, of a terminal spring engaging one end thereof and connected with one terminal thereof, a heat-conducting rod extending through said heat-coil and connected with the other terminal thereof, a second terminal spring adapted to engage one end of said rod, a pressure-spring engaging the other end of said heat-coil and tending to move said heat-coil to prevent engagement of said rod with said second terminal spring, and a plate of heat-responsive material normally engaging the other end of said rod to prevent disengagement of said rod from said second terminal spring by said pressure-spring, abnormal current-flow through said heat-coil causing said rod to pass through

said heat-responsive plate to allow said pressure spring to disengage said rod from said second terminal spring.

7. In a thermal cut-out and circuit-changer, the combination with a heat-coil, of a terminal spring engaging one end thereof and connected with one terminal thereof, a rod extending through said heat-coil and connected with the other terminal thereof, a second terminal spring, a pressure-spring engaging the other end of said heat-coil and tending to disengage said rod from said second terminal spring, said terminal springs and pressure-spring being insulated from each other and secured to a ground-plate, a plate of heat-responsive material normally engaged by the other end of said rod to prevent said pressure-spring from disengaging said rod from said second terminal spring, abnormal current-flow through said heat-coil causing said rod to be released from said heat-responsive plate and from said second terminal spring, and means for connecting said first terminal spring with said ground-plate upon the release of said rod.

8. In a thermal cut-out and circuit-changer, the combination with a heat-coil, of a terminal spring engaging one end thereof and connected with one terminal, a metallic rod passing through said heat-coil and connected with the other terminal thereof, a second terminal spring normally engaging one end of said rod, a switching-spring tending to disengage said second spring from said rod, a heat-responsive mass normally engaging the other end of said rod to maintain said rod in engagement with said second terminal spring, abnormal current-flow through said heat-coil causing the release of said rod from said heat-responsive mass and from said second terminal spring, a ground-plate, and means for causing said first terminal spring to be connected with said ground-plate upon release of said rod.

9. In a thermal cut-out, the combination with a heat-coil, of a terminal spring connected with one terminal thereof, a metallic rod passing through said coil and connected with the other terminal thereof, said rod being permanently stationary relative to the other parts of said heat-coil, a second terminal spring normally engaged by said rod, a switching-spring tending to disengage said second spring from said rod and a heat-responsive mass normally engaging the other end of said rod to maintain connection of said rod with said second terminal spring, abnormal current-flow through said coil causing release of said rod, from said heat-responsive mass whereby said switching-spring may break the connection between said second terminal spring and said rod.

10. In a thermal cut-out, the combination with a heat-coil, of a terminal spring connected with one terminal thereof, a metallic

rod passing through said coil and connected with the other terminal thereof, said rod being permanently stationary relative to the other parts of said heat-coil, a second terminal spring normally engaged by said rod, a switching-spring tending to disengage said second spring from said rod, a heat-responsive mass normally engaging the other end of said rod to maintain connection of said rod with said second terminal spring, a normal current-flow through said coil causing release of said rod from said heat-responsive mass whereby said switching means may break the connection between said second terminal spring and said rod, a ground-plate upon which said terminal springs are mounted, and means for connecting said first terminal spring with said ground-plate upon release of said rod.

11. In a thermal cut - out and circuit-changer, the combination with a heat-coil, of a terminal spring connected with one terminal thereof, a metallic rod passing through said heat-coil and permanently stationary relative thereto and connected with the other terminal thereof, a second terminal spring normally engaging said rod, a switching-spring tending to disengage said second spring from said rod and a plate of heat-responsive material normally disposed before the other end of said rod to maintain said rod in engagement with said second terminal spring, abnormal current-flow through the said coil causing said rod to puncture said heat-responsive plate to allow disengagement of said rod from said second terminal spring by said switching-spring.

12. In a thermal cut - out and circuit-changer, the combination with a heat-coil, of a terminal spring connected with one terminal thereof, a metallic rod passing through said heat-coil and permanently stationary relative thereto and connected with the other terminal thereof, a second terminal spring normally engaging said rod, a switching-spring tending to disengage said second spring from said rod, a plate of heat-responsive material normally disposed before the other end of said rod to maintain said rod in engagement with said second terminal spring, abnormal current-flow through the said coil causing said rod to puncture said heat-responsive plate to allow disengagement of said rod from said second terminal spring by said switching-spring, a ground-plate upon which said terminal springs are mounted, and means for connecting said first terminal spring with said ground-plate upon release of said rod.

13. In a thermal cut-out, the combination with a heat-coil, of a terminal spring engaging one end thereof and connected with one terminal thereof, a metallic rod passing through said coil and permanently stationary with respect thereto and connected with the other

terminal thereof, a second terminal spring normally engaging one end of said rod, a switching-spring tending to disengage said second terminal spring from said rod, a heat-responsive mass normally disposed against the other end of said rod to prevent disengagement of said second terminal spring from said rod, abnormal current-flow through said coil causing softening of said heat-responsive mass to allow said rod to be pressed into said mass by said switching-spring, whereby said rod becomes disengaged from said second terminal spring.

14. In a thermal cut - out and circuit-changer, the combination with a heat-coil, of a terminal spring connected with one terminal thereof, a rod passing through said coil and connected with the other terminal thereof, a second terminal spring normally engaging one end of said rod, a switching-spring tending to disengage said rod from said second terminal spring, a sleeve disposed at the other end of said rod, an opening through the walls of said sleeve, and a plate of heat-responsive material adapted to pass through said sleeve to engage the other end of said rod to normally detain said rod in engagement with said second terminal spring against the action of said switching-spring, abnormal current-flow through said coil causing said rod to pass through said plate of heat-responsive material to allow release of said rod from said second terminal spring.

15. In a thermal cut - out and circuit-changer, the combination with a heat-coil, of a terminal spring connected with one terminal thereof, a metallic rod passing through said coil permanently stationary with respect to said coil and connected with the other terminal thereof, a second terminal spring normally engaged by one end of said rod, a switching-spring tending to disengage said second terminal spring from said rod, a third spring connected with said first terminal spring, a ground-plate upon which said springs are mounted, a lightning-arrester clamped between said bar and said third spring, a sleeve at the upper end of said third spring, an opening through the walls of said sleeve adapted to receive the other end of said rod, a plate of heat-responsive material held in said sleeve to normally prevent passage therethrough of said rod to maintain said rod in engagement with said second terminal spring against the action of said switching-spring, abnormal current-flow through said coil causing said switching-spring to move the rod to puncture said plate of heat-responsive material, whereby said rod becomes disengaged from said second terminal spring, and means for causing said first terminal spring to be connected with said ground-plate upon release of said rod.

16. In a thermal cut-out, the combination with a heat-coil, of a terminal spring engaging one end thereof and connected with one

terminal thereof, a pressure-spring engaging the other end of said heat-coil, a rod passing through said coil and connected with the other terminal thereof, a second terminal spring, said pressure-spring tending to move said coil to disengage said rod from said second terminal spring, a heat-responsive mass normally disposed against the other end of said rod to prevent disengagement of said rod from said second terminal spring by said pressure-spring, abnormal current-flow through said coil causing softening of said heat-responsive mass, whereby said pressure-spring may carry the heat-coil to cause said rod to penetrate into said heat-responsive mass, whereby said rod becomes disengaged from said terminal spring.

17. In a thermal cut-out, the combination with a heat-coil, of a terminal spring engaging one end thereof and connected with one terminal thereof, a pressure-spring engaging the other end of said heat-coil, a rod passing through said heat-coil and connected with the other terminal thereof, a second terminal spring normally engaging one end of said rod, said pressure-spring tending to disengage said rod from said second terminal spring, a plate of heat-responsive material, and means for normally disposing said plate before the other end of said rod, abnormal current-flow through said coil causing softening of said heat-responsive plate, whereby said pressure-spring may cause said rod to puncture said plate to disengage said rod from said second terminal spring.

18. In a thermal cut-out, the combination with a heat-coil in the form of a winding surrounded by a shell and a heat-conducting rod extending through said winding and shell, of terminal springs between which said coil is disposed, each of said springs being connected with a terminal of said winding, a switching-spring tending to disconnect said winding from said terminal springs, and electrically non-conductive heat-responsive material tending normally to resist disconnection of said winding from said terminal springs, abnormal current-flow causing said heat-responsive material to be unable to resist disconnection of said winding from said terminal springs by said switching-spring.

19. In a thermal cut-out, the combination with a heat-coil structure comprising a winding inclosed by a shell and a heat-conducting rod extending through said winding and shell, terminal springs associated with said heat-coil structure, means tending to bodily move said heat-coil structure in one direction and an electrically non-conductive heat-responsive element adapted to prevent such movement of the heat-coil structure and to maintain connection of the terminals of said winding with said terminal springs, abnormal current-flow through the winding causing said heat-responsive member to be un-

able to prevent movement of the heat-coil structure, whereby the connection of said winding with one of the terminal springs is broken.

20. In a thermal cut-out, the combination with a heat-coil, of terminal springs associated therewith, means tending to bodily move the heat-coil to disconnect said heat-coil from circuit with said terminal springs, and a heat-responsive member of insulating material and adapted under normal conditions to resist disconnection from circuit of said heat-coil by said means, abnormal current-flow causing said heat-responsive member to be rendered unable to resist disconnection of said heat-coil from circuit with said terminal springs.

21. In a thermal cut-out, the combination with a heat-coil structure composed of a winding surrounded by a shell and a heat-conducting member extending through said shell and winding, said winding, shell and heat-conducting member being relatively immovable, of terminal springs for normally engaging the terminals of said winding, a switching-spring tending to bodily move the heat-coil structure in one direction to disconnect one of the winding-terminals from the corresponding terminal spring, and an abutment of heat-responsive material adapted to normally resist the bodily motion of said heat-coil structure and the consequent disconnection of said winding from circuit, abnormal current-flow through said winding causing said abutment to be rendered incapable of resisting the bodily movement of the heat-coil structure, whereby said winding is disconnected from circuit with said terminal springs.

22. In a thermal cut-out, the combination with a heat-coil structure comprising a winding surrounded by a shell and a heat-conducting rod extending through said shell and winding, of a supporting-spring from which said heat-coil structure is supported, terminal springs between which the heat-coil structure is disposed and with which the terminals of the winding are normally connected, said supporting-spring tending to bodily move the heat-coil structure to break the connection between one terminal spring and the winding, and an abutment of heat-responsive material engaging the end of said conducting-rod and adapted under normal conditions to resist the bodily movement of the heat-coil structure whereby to maintain the connection of the winding in circuit, abnormal current-flow through the winding causing heating of the rod and heat-responsive member whereby said member is rendered incapable of resisting the bodily movement of said heat-coil structure, whereby said winding is disconnected from circuit.

23. In a thermal cut-out, the combination with a heat-coil structure comprising a wind-

ing surrounded by a shell and a heat-con-
ducting rod extending through said winding
and shell, of a switching-spring from which
said heat-coil structure is supported, a ter-
5 minal spring connecting with one terminal of
the winding, a second terminal spring adapt-
ed for connection with the other terminal of
said winding, a ground connection adapted
for engagement with the first terminal spring,
10 said switching-spring tending to bodily move
the heat-coil structure to cause connection of
the first terminal spring with the ground con-
nection and disconnection of the other ter-
minal of the winding from the second termi-
15 nal spring, and an abutment of heat-respon-
sive material engaged by the end of said heat-
conducting rod and adapted under normal

conditions to resist bodily movement of said
heat-coil structure to maintain said winding
in circuit and to prevent grounding of the 20
first terminal spring, abnormal current-flow
through the winding causing said rod and
heat-responsive member to be heated where-
by the heat-responsive member is rendered
incapable of resisting movement of said heat- 25
coil structure, thereby allowing grounding of
the first terminal switch and disconnection
from circuit of the winding.

In witness whereof I hereunto subscribe
my name this 1st day of June, A. D. 1904.

ALFRED O. STIGBERG.

Witnesses:

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