No. 628,762. Patented July 11, 1899.

C. M. CLARK.

AUTOMATIC CIRCUIT BREAKER.

(Application filed Jan. 23, 1899.)

(No Model.)

FIG. 2.

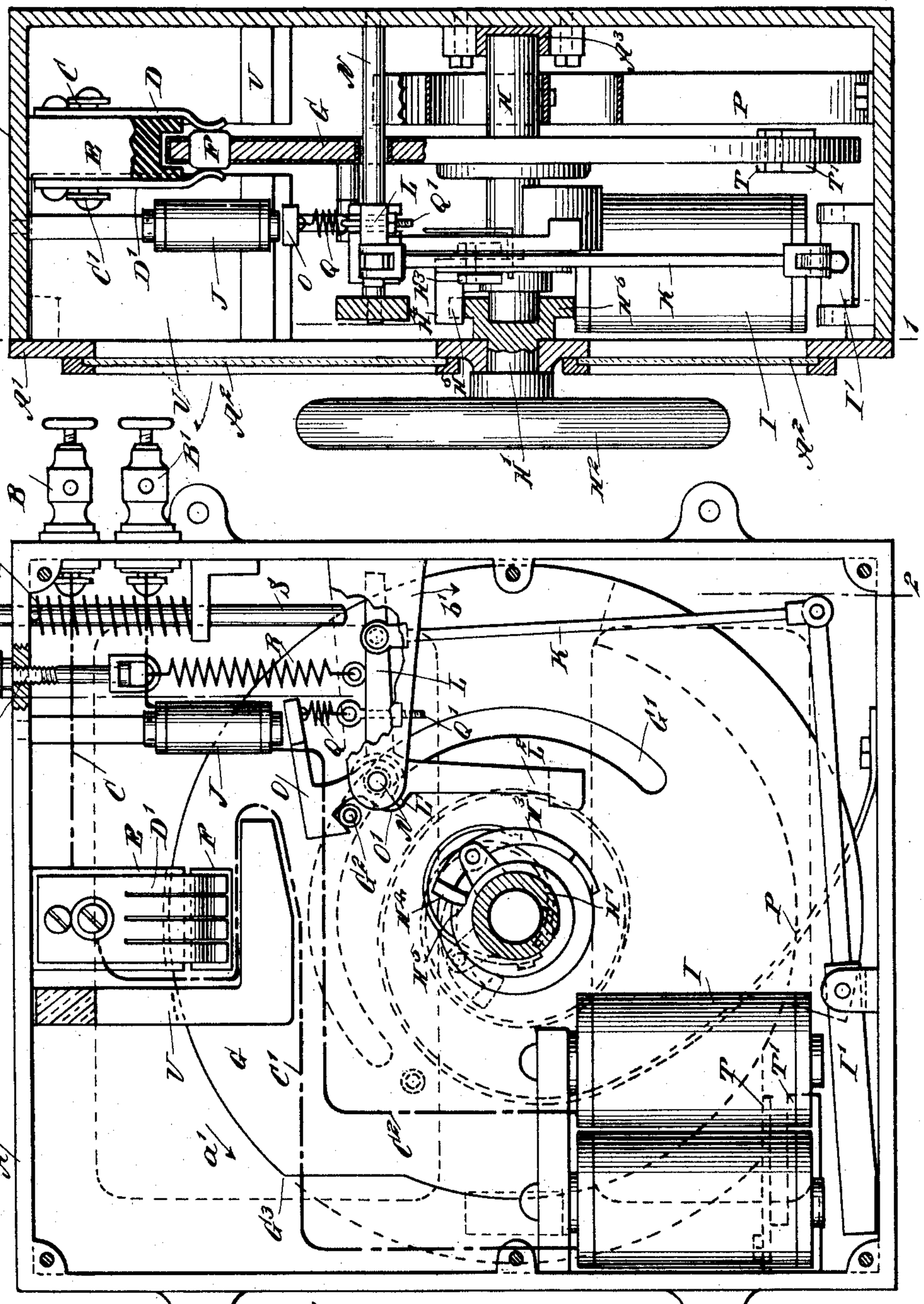

FIG. 1.

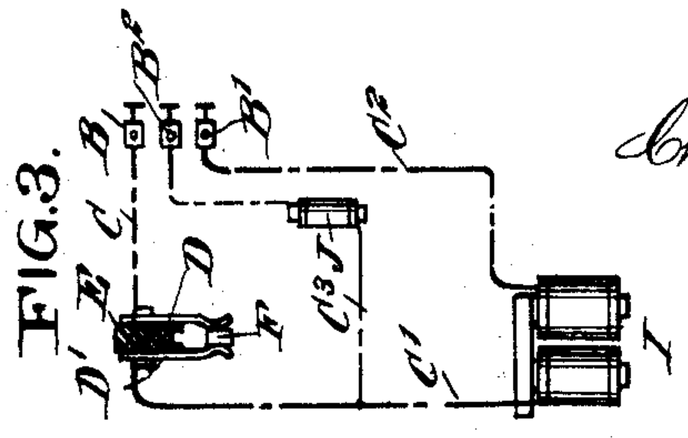

FIG. 3.

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AUTOMATIC CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 628,762, dated July 11, 1899.

Application filed January 23, 1899. Serial No. 703,099. (No model.)

To all whom it may concern:

Be it known that I, CHARLES M. CLARK, of the city of New York, borough of Brooklyn, in the county of Kings and State of New York, have invented a new and Improved Automatic Circuit-Breaker, of which the following is a full, clear, and exact description.

The invention relates to automatic magnetic circuit-breakers such as shown and described in the Letters Patent of the United States No. 616,405, granted to me on December 20, 1898.

The object of the present invention is to provide a new and improved automatic circuit-breaker which is simple and durable in construction, very sensitive in operation, and arranged to break the circuit without danger of sparking immediately upon the current breaking when becoming either underloaded or overloaded.

The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

A practical embodiment of my invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional front elevation of the improvement on the line 11 in Fig. 2. Fig. 2 is a transverse section of the same on the line 2 2 in Fig. 1, and Fig. 3 is a diagrammatic view of a modified form of the improvement.

The improved automatic circuit-breaker is mounted in a suitably-constructed casing A, having a cover A′ provided with glass panes A^2 to permit of conveniently examining the working of the apparatus located in the casing without opening the cover.

On the casing A, preferably at one side thereof, are arranged the binding-posts B B′, connected with the ends of the wire forming a circuit, the binding-post B being connected by a wire C with a brush D, secured on one side of a block E, of insulating material, and secured to the top of the casing, as is plainly illustrated in the drawings. The free end of the brush D is in contact with one side of a metallic block F, secured in the web of a disk G, preferably made of iron covered with agate, enamel, or other insulating material for insulating the iron, the disk being secured on a shaft H, mounted to turn in the casing. The block F is adapted to be engaged at its other side by a brush D′, likewise secured to the block E and connected by a wire C′ with an electromagnet I of the usual construction and from which leads a wire C^2 back to the binding-post B′, an electromagnet J being in said wire for actuating the apparatus on an underload, as hereinafter more fully described, it being understood that a solenoid or other device may be used instead of the electromagnet J.

The electromagnet I is provided with a pivoted armature I′, connected by a link K with a lever L, the shaft N of which is mounted to turn in suitable bearings in the casing A, and on said shaft is fulcrumed loosely a latch O, adapted to engage a pin G^2, projecting from the face of the disk G, so as to lock the latter against rotation by its helical spring P and to normally hold the disk in such position that the block F is in contact with both brushes D D′. When the latch O is swung out of engagement with the pin G^2, then the disk G is free to revolve in the direction of the arrow *a′* by the action of the helical spring P to move the block F out of engagement with the brushes D D′ and break the circuit.

The core of the electromagnet J is arranged directly above the free end of the latch O above the top thereof, and the under side of the free end of said latch is engaged by a spring Q, held on a screw-rod Q′, adjustable in the lever L to permit of regulating the tension of said spring Q. The tendency of the spring Q is to swing the latch O out of engagement with the pin G^2, while the electromagnet J tends to hold the said latch normally in engagement with the pin G^2, it being understood that the electromagnet J and the spring Q normally about counterbalance each other; but in case of an underload in the current passing through the electromagnet the force of the electromagnet is correspondingly reduced, and the spring Q can now impart a swinging motion to the latch O to disengage the same from the pin G^2 and unlock the disk G to allow the same to turn by the action of the spring P and break the circuit, as before mentioned.

The lever L is formed at its fulcrum end

with a lug L′, adapted to engage a corresponding lug O′ on the fulcrum end of the latch O, so that when the lever L is swung downward in the direction of the arrow *b′* at the time the electromagnet I is energized on an overload of the current, then the lug L′, by engaging the lug O′, swings the latch O out of engagement with the pin G^2 to unlock the disk and permit the latter to turn in the direction of the arrow *a′* to break the circuit. It is understood that the electromagnet I does not energize sufficiently to attract its armature I′ as long as the current is of a normal force; but as soon as the current becomes excessive the armature I′ is attracted for releasing the disk G by the action of the lever L and the latch O, as above described.

The core of the electromagnet, as well as the lever L, may be laminated in case alternating currents are used instead of direct ones.

The lever L is normally held in the position shown in Fig. 1 by the action of a spring R, connected with an adjusting-bolt R′, screwed in the casing, to permit of regulating the tension of the spring according to the strength of the current for which the apparatus is set. The lever L is adapted to be engaged by a rod S, fitted to slide in suitable bearings in the casing A, the upper end of the said rod extending to the outside of the casing, the rod being normally held in an uppermost position, as shown in Fig. 1, by the action of a spring S′, coiled on said rod. The outer end of the rod S is provided with a suitable handle or knob S^2, adapted to be taken hold of by the operator and pressed to slide the rod downward and move it in engagement with the lever L, so as to impart a swinging motion thereto in the direction of the arrow *b′* for throwing the latch O out of engagement with the pin G^2 whenever it is desired to break the circuit. This arrangement forms a switch for the circuit-breaker to allow the operator to break the circuit whenever desired.

In order to prevent resetting of the machine by the operator before the excessive current is turned off, I provide an arrangement similar to that described in the patent previously referred to, the construction being as follows: The shaft H, carrying the disk G, is mounted to turn at one end in a bearing A^3, attached to the back of the casing A, the other end of the shaft being coupled to a shaft H′, mounted to turn in bearings formed in the cover A′, as indicated in Fig. 2. A hand-wheel H^2 is secured to the outer end of the shaft H′ for allowing the operator to reset the machine, and the coupling between the shafts H and H′ consists of a spring-pressed pawl H^3, fulcrumed on the shaft H and formed with a lug H^4, normally engaging a notch H^5 in the periphery of a collar H^6, formed or secured on the inner end of the shaft H′. The free end of the pawl H^3 is adapted to be engaged by an arm L^2, extending from the lever L, so that when the operator turns the hand-wheel H^2 to reset the machine before the excessive current is turned off then the lever L is immediately actuated again and the arm L^2 imparts a swinging motion to the pawl H^3, so as to disengage the lug H^4 thereof from the notch H^5 and allow the spring P of the disk to again rotate the same in the direction of the arrow *a′* to break the circuit. Thus the shafts H H′ are automatically disconnected, and the machine cannot be reset unless excessive current is shut off.

As indicated in the drawings, the shaft N for the lever L extends through a segmental slot G′ in the disk G; but it is understood that this is not essential, as the shaft may be journaled in bearings on one side of the disk.

In order to break the force of the final rotary motion of the disk G after the circuit is broken and before the wall of the slot G′ comes in contact with the shaft N, I provide a spring T, secured on a suitable block T′, attached to the casing, the free end projecting into the path of an offset or shoulder G^3, formed on the disk G. (See Fig. 1.) Thus when the latch O disengages the pin G^2 and the helical spring P rotates the disk G in the direction of the arrow *a′* then the shoulder G^3 finally comes in contact with the spring T, which is compressed, and brings the disk to a gradual stop.

The blow-out device for preventing arcing at the time the circuit is broken consists of an L-shaped plate U, of enameled iron and secured to the inside of the casing A. The plate U is formed with a longitudinal slot to produce two forked members straddling the disk G at its faces, the horizontal members of the plate extending immediately below the lower edges of the brushes and the vertical member extending at one side of the brushes, as will be readily understood by reference to Figs. 1 and 2. The horizontal members of the plate prevent a possible downward jumping of the arc to the detriment of working parts of the apparatus located below said members.

It is evident that when the disk G is rotated for breaking the circuit the spark produced by the block F leaving the free ends of the brushes is readily extinguished by the blow-out plate U.

The operation is as follows: As long as the current is normal the several parts remain in the position shown in Figs. 1 and 2 and the circuit passes from the binding-post B by the wire C, brush D, block F, brush D′, wire C′, electromagnet I, wire C^2, and electromagnet J to the binding-post B′. When an excessive current passes through the circuit, as described, then the electromagnet I is energized to such an extent that the armature I′ is attracted and the latch O is thrown out of engagement with the pin G^2 to allow the spring P to rotate the disk G in the direction of the arrow *a′*, as previously described, to move the block F out of engagement with the brushes D D′ and break the circuit. In case of an un-

dercurrent the attractive force of the electromagnet J decreases to such an extent that the spring Q overbalances and throws the latch O out of engagement with the pin G^2 to unlock the disk and allow its spring to rotate and to break the circuit in the manner previously described. In case the operator desires to break the circuit he simply presses the knob S^2, as above explained. It is understood that after the current is broken and the excessive current is shut off the operator can reset the device by turning the hand-wheel H^2 in the inverse direction of the arrow a' to bring the several parts back into position, as above described, and illustrated in Figs. 1 and 2.

By the arrangement described the strength of the current controls the electromagnet J, so that the underload arrangement is actuated upon a decrease of the strength of the current; but in order to actuate the device on an underload according to a decrease in the voltage I use the arrangement shown in Fig. 3, in which the electromagnet J is connected by a wire C^3 with the wire C' and with a separate binding-post B^2. The electromagnet J counterbalances the spring Q until a decrease in the voltage of the current takes place. The current passing through the wire C^3 is entirely dependent on the electromotive force of the current, since the coil J is shunted across the circuit to receive the full electromotive force of the line irrespective of the strength of the current. If the electromotive force weakens from any cause, it is evident that the coil J is proportionately weakened and causes a release of the disk by the mechanism described. If the voltage increases, it increases the coil J, but does not actuate it.

The block F may have its forward end made of carbon or other material, so that final breaking of the circuit takes place after the metal block has left the brushes and the carbon is about to leave the same. This arrangement is serviceable for heavy currents.

In machines for overloads only the electromagnet J is dispensed with, and the spring Q is then made a push-spring instead of a pull-spring, as shown and described. It is, however, understood that in either case the construction of the latch-lever and spring is made use of, as it permits easy engagement of the latch with the pin on resetting irrespective of the lever. The block F projects a suitable distance on the faces of the disk to make proper contact with the free ends of the brushes, the said free ends being thus prevented from coming into contact with and scraping the face of the disk G.

It is understood that two or more disks may be employed or that in one disk two or more contact-blocks may be placed and so arranged that one will break the contact with its brushes previous to the other, which will make the final break. In this case it is preferable to make the second block of platinum or the like, as it is not liable to fuse or melt by the arc.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. A circuit-breaker, provided with a spring-pressed rotary disk normally in position to render the circuit continuous, an electromagnet in the circuit and arranged for action on an overload of current, a spring-pressed latch for normally locking the disk against the tension of its spring, a connection between the latch and the electromagnet for actuating the latch and unlocking the disk upon an overload of current and an electromagnet for the latch, and likewise in the circuit for movably holding the latch in a locking position relatively to the disk and for permitting the spring of the latch to actuate the latter and unlock the disk upon the passing of an underload of current, substantially as shown and described.

2. A circuit-breaker, comprising a spring-pressed rotary insulated disk, a contact-block seated in the disk, fixed brushes normally engaging the said block on each side of the disk, said brushes being in an electric circuit, an electromagnet in the circuit and arranged for action on an overload of current, a spring-pressed latch for normally locking the disk against the tension of its spring, a connection between the latch and the electromagnet, for actuating the latch and unlocking the disk upon an overload of current, and an electromagnet for the latch, and likewise in the circuit for normally holding the latch in a locking position relatively to the disk, and for permitting the spring of the latch to actuate the latter and disengage or unlock the disk upon an underload of current passing through the solenoid, substantially as shown and described.

3. A circuit-breaker provided with a spring-pressed rotary disk normally in position to render the circuit continuous, a latch for locking the disk against rotation by its spring, a spring for drawing the latch out of a locking position relatively to said disk, and a device controlled by the current and in which no break of the current occurs, for counterbalancing the action of said spring, to hold the latch normally in a locked position, and to allow the spring to move the latch out of a locked position upon a decrease of current or drop in voltage, substantially as shown and described.

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Witnesses:
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