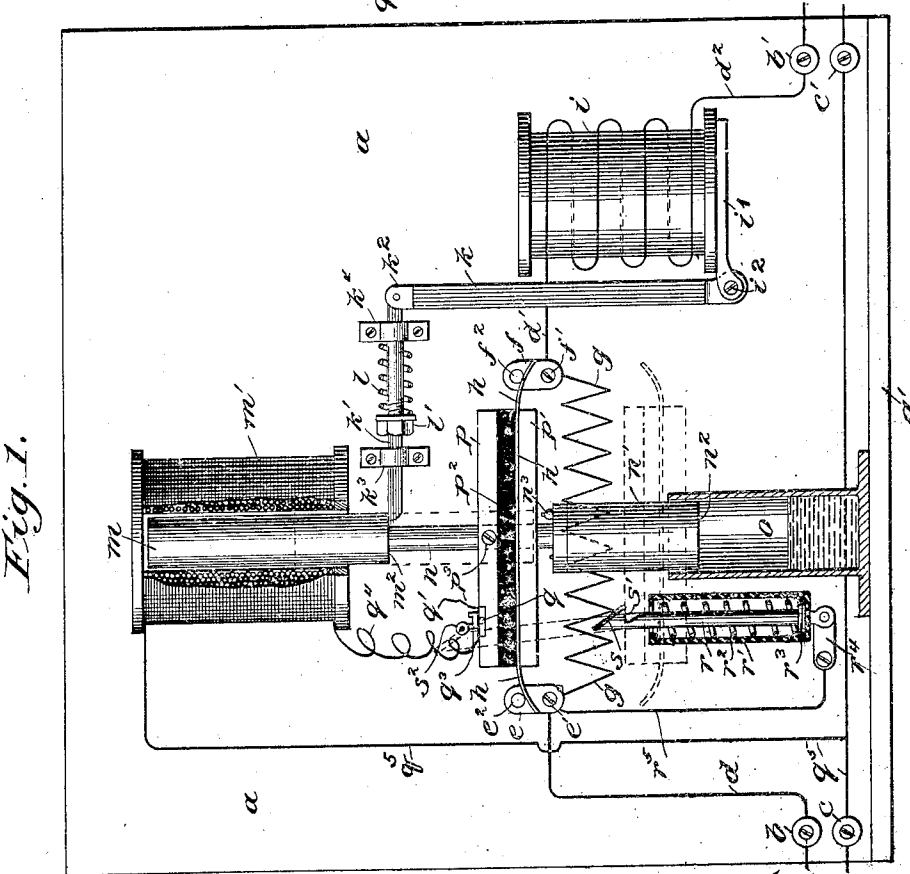
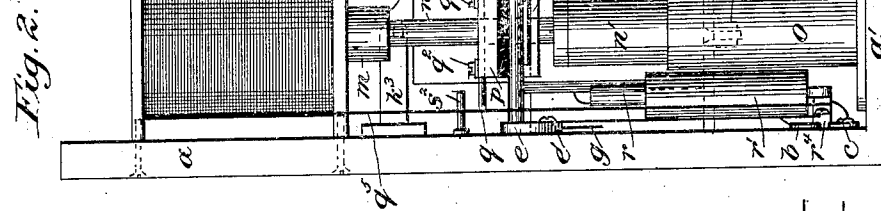
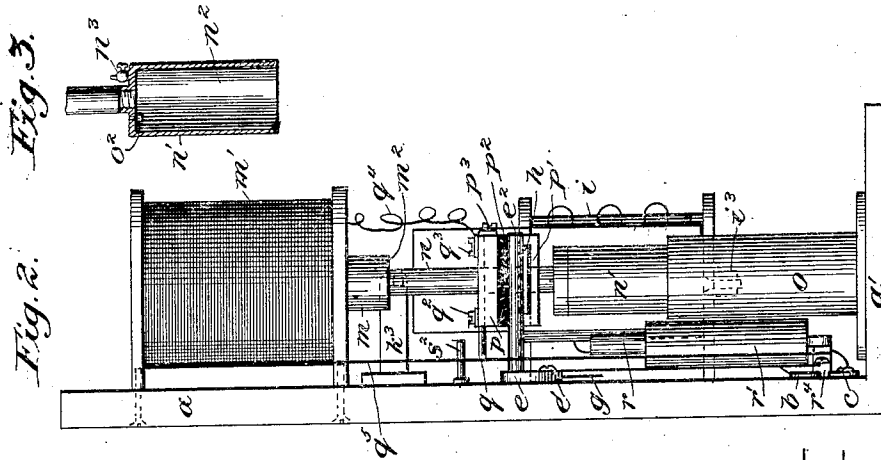


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ELECTRIC WORK CIRCUIT REGULATING MONITOR.
APPLICATION FILED DEC. 14, 1906.

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Patented May 27, 1913.



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ELECTRIC WORK-CIRCUIT-REGULATING MONITOR.

1,062,978.

Specification of Letters Patent.

Patented May 27, 1913.

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To all whom it may concern:

Be it known that I, FRANK KRAEMER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Work-Circuit-Regulating Monitors, of which the following is a specification.

In supplying electric current energy to local consumers from a central power station, the method of charging patrons varies with the special needs of the consumer and the nature of the installation. One method having a constantly increasing field of application is commercially known as the "flat rate system," since a flat rate is made for the number of watts used, this rate being fixed by contract for any given local light or power circuit. In contracting under this method or system the number of lamps or other units of current consumption in the derived circuit is taken as a basis; a price is determined upon for supplying this local installation with current, at so much per hour, and the use of a watt meter is dispensed with. Or the charge may be so much per diem, based on running the plant a certain number of hours, to be definitely agreed upon. In such case the charge will be simply the flat rate multiplied by the number of days of service.

In the flat rate system any addition of consuming units on the part of the patron will result at once in loss to the supplier, as there can be no additional charge. It is an easy matter to wire up for more units without the knowledge of the supplier and the various power and light supplying companies have suffered much from illicit tapping of the current under the flat rate system, yet the system has been found so convenient in other respects that it is very desirable to retain it, while removing the possibility of using more current than was contracted for.

The present invention provides an apparatus which automatically prevents such fraudulent and illicit use of current. This is accomplished as follows: The attraction of an electro-magnet is sufficiently intensified by any increase of the number of lamps or other translating devices in the circuit beyond that allowed, owing to the increased current, to enable it to overcome the resistance of a spring, and causes a normally

closed derived or switch circuit of good conductivity to be opened, throwing the current into a very high resistance which permanently connects the switch circuit terminals, thus permitting only a very feeble current to pass through the lamps. The period of opening of the switch is variable at will and at the end of the period a solenoid is automatically thrown into shunt with the main line, and closes the switch, restoring the full current. This dimming of the lamps, or weakening of power, warns the consumer that the lamp circuit has been unduly taxed and that the act has been detected. If now, the additional lights are cut out the remaining or legitimate lights continue to burn brightly, but if the extra load has not been removed the switch is again dropped and the above action is repeated. Thus a series of dark periods broken by flashes of lighting up results, which produces a condition more vexatious to the consumer than even total cessation of the current would be, so that he will promptly remove the extra load. The duration of the period of dimness depends on the period of opening of the switch, and this may be varied between considerable limits. The means provided for securing this action, and the mode of operation are fully described in the following specification, and illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of apparatus embodying my invention in the best form now known to me, showing parts in longitudinal section, and diagrammatically illustrating the circuits and connections; Fig. 2, a side elevation of said apparatus, and Fig. 3, an enlarged detail showing the brake plunger.

Referring now to said drawings, the base plate *a*, made of wood, slate, marble, or similar nonconducting material, and provided with the ledge *a*¹, integral with it, carries the binding screws *b*, *b*¹ and *c*, *c*¹ by means of which the apparatus is placed in the branch circuit which furnishes the current to the consumer from the supply mains. The positive wire enters at *b* and passes on to the lamp circuit proper and out at *b*¹; and the negative wire of the lamp circuit comes into the monitor at *c* and passes on to the local circuit out of *c*¹. Within the apparatus the positive wire *d*, *d*¹, *d*² is first led to a connection plate *e* secured to the base

plate by the binding screw e^1 and carrying preferably integral with it, the projecting contact post e^2 . An identical connection plate f secured to the base plate at the same height as plate e , and a short distance from it, by means of the binding screw f^1 , is provided with contact post f^2 . The continuation d^1 of the positive wire passes out of this connection plate to the electro-magnet i , forming the winding thereof, and from that it goes out to the lamp circuit proper. The magnet i , more fully described later on, is wound with but a few turns relatively of wire of sufficient diameter to form a conductor of low resistance, this being necessary in order to avoid diminution of current in the local circuit. The conductors d , d^1 are united to the connection plates e , f , in some suitable manner forming a good contact, and in practice these permanent parts of the circuit may advantageously be strips of copper, or similar material of good conductivity.

The two plates e and f are permanently connected, electrically speaking, by a high resistance g , the ends of which are secured to the plates in any one of the many well-known ways that will provide a good contact, and which is constantly closed to afford a permanent path for the circuit, unvaried by the intrinsic mode of operation of the machine or apparatus. The resistance is preferably of the rheostat type, and variable within limits conditioned by the nature of the service. In addition to this connection the plates are normally joined by a low resistance switch h , herein shown as of the spring bridge type, bearing against the underside of the contact posts e^2 , f^2 , and supported as will be described farther on.

The electro-magnet i , secured to the base plate in any suitable manner, has a strap i^1 of brass or other diamagnetic metal secured to its base and terminating in the hinge eyes i^2 , to which strap is hinged the upright iron link-armature k . The latch stem k^1 , hinged at k^2 to the upper end of the link k , is slidingly journaled in the standards k^3 , k^4 projecting from and secured to the base plate. A coil spring l , resting at its rear end against the standard k^4 and at its forward end (to wit, the end toward the left in Fig. 1) against the nut l^1 , presses the latch forward, holding the link-armature away from the upper pole-shoe of the electro-magnet. The latch stem is threaded for a sufficient length to allow of material alterations of compression of the spring. The forward part of the latch stem is an ordinary latch normally engaging under and supporting the solid iron cylinder m forming the core of the solenoid m^1 . This solenoid is fastened to the base plate with screws, as shown, with its axis passing midway between the contact posts e^2 , f^2 . The solenoid is closed at its upper

end and the core is prolonged at its lower end to reach well beyond the solenoid, to the plane of the top of the latch. At this point the diameter is abruptly reduced, forming a shoulder m^2 which serves for the engagement of the latch, and leaving, as a continuation of the stock, the plunger rod n , to which is firmly attached the hollow plunger n^1 , the chamber n^2 of which opens downward and which projects into and closely fits the brake cylinder o , which rests on and is secured to the ledge a^1 of the base plate. The brake cylinder contains oil, glycerin, or similar fluid, which, when the plunger falls, enters into the chamber n^2 thereof, tightly sealing the sides of the plunger with the inner wall of the cylinder, and causing the air within to become compressed. The stop-cock n^3 in the plunger permits this air to escape, the rate of escape being regulated by the amount of opening, and thus controls the rate of descent of the plunger. The automatic valve o^2 in the top of the plunger closes under the air pressure as the plunger descends, and opens by gravity when the pressure is taken off, which occurs when the plunger has completed its descent. The length of the solenoid core is so proportioned to the length of the brake cylinder that when the plunger has completed its descent the upper part of the core still projects well into the solenoid. The core is shown in its lowest position by the dotted lines.

The switch h is a broad elastic strip or copper or similar conducting material incased between the wood strips p , p^1 , bound together by screws or similar suitable means, and holding against the upper surface of the switch the insulating stratum p^2 of fiber or equivalent material. The plunger rod n passes through a hole cut in the center of the switch casing, which is adjustably secured to the rod by the set screws p^3 . The rod is suitably insulated from the switch. The contact pin q (Fig. 2) projects rearwardly from the top of the switch casing and directly over the axis of the detent to be described. It is connected and preferably integral with the conducting strip q^1 , secured to the top of the switch casing by the screws q^2 , q^3 , of which the latter has fastened to it the end of the wire q^4 , being one of the terminals of the solenoid winding. The other terminal wire is q^5 branching out from the negative line wire. The ends of the switch blade project outside of the casing wall beyond the contact posts e^2 , f^2 , and the casing is so set on the rod that these blade ends are normally pressed hard up against the under sides of the contact posts, forming good electric connections therewith. The detent stem r is housed in the detent casing r^1 mounted on a hinge connection secured to the base plate, so as to permit of some movement laterally. The coil spring r^2 , oper-

ating between the cover of the detent casing and a disk or piston r^3 which is mounted on the lower part of the stem, and preferably integral therewith, acts to keep the detent down, and draws it back to its normal position when raised. The detent spring, disk and casing are made of conducting material and the casing is electrically connected by the strip r^4 to a binding screw which connects the detent with the positive wire through the branch r^5 running out from the connection plate e . At its upper end the detent stem is fashioned into a bevel s , similar to that of a lock-bolt, and covered with insulating material, preferably fiber. Beneath the end of this bevel the detent hook s^1 is formed in the stem. The pin s^2 , projecting from the base plate, is located above the detent casing and slightly to one side of the axis thereof, away from the side on which the hook is located, so that when the detent is raised the bevel will strike against this pin and thereby force the hinged casing to one side, away from it, sufficiently to disengage the hook from any pin that may have been engaged by it when the stem was vertical.

The operation of the apparatus is as follows: Normally the solenoid core rests on the latch, the switch connects the terminals e^2 , f^2 , and the current flows through the switch and the resistance which is in shunt between the above terminals; the full current is supplied to the local circuit, lamps, motors, etc. The nut l is adjusted on the latch screw so that the spring offers just sufficient resistance to overcome the pull of the electro-magnet on the link armature, and no more. Let it now be assumed that an extra lamp is put on the local circuit. The resistance of that circuit will at once be diminished, hence a stronger current will flow around the electro-magnet causing the latter to attract its armature sufficiently to overcome the resistance of the spring so that the latch is drawn back, and the now unsupported solenoid core falls, carrying with it the switch and thereby throwing the latter out of the circuit. As the current can now pass between the connection plates e and f by no path other than the high resistance g , it is at once very decidedly diminished in strength, so that all the lights are materially dimmed. The amount of reduction of the current strength depends on the amount of the permanent resistance used, and as the latter can be altered at will the precise amount of current reduction desired can be attained. As the plunger descends it compresses the air contained in the brake cylinder so that its fall is retarded the amount depending on the opening of the vent or stop-cock. When the projection q has been carried by the descending switch casing as far as the bevel of the detent it

tilts the latter slightly to one side, and sliding on the bevel it catches under the hook. This completes the electrical connection between the solenoid winding and the positive wire, and throws the solenoid into shunt with the main line; the path of the shunt current being e , r^5 , r^4 , r , q , q^1 , q^4 , and solenoid m^1 , back through q^5 to the negative wire. The connection of the wire q^4 is such that sufficient slack is left to allow the switch casing to drop freely. As soon as the solenoid circuit is closed the core is drawn upward and carries the detent with it against the resistance of the detent spring. When the switch casing has risen sufficiently far to bring the bevel of the detent into bearing with the projecting pin s^2 , the latter causes the hinged casing to deflect toward the left, as shown in the dotted lines in Fig. 1, and thereby throws the detent hook clear of the pin q . This breaks the solenoid circuit and permits the detent to be snatched back to its casing by the spring. The spring switch is so positioned with reference to the pin s^2 that this action takes place at the same instant when the line circuit is reestablished by the contacting of the switch blade ends with the contact posts e^2 , f^2 . When the low resistance line circuit was broken by the falling of the switch the reduction in current strength caused the electro-magnet to become so weak that the spring prevailed over it and the nose of the latch is pressing against the side of the core while the latter is out of the normal position. Therefore as soon as the core has been drawn up sufficiently far to close the switch, and the shoulder of the solenoid clears the latch point, the latch shoots forward and again supports the solenoid. The relation of parts is so proportioned that the three acts of breaking the solenoid circuit, closing the main switch and latching the solenoid core are simultaneous. Now all the parts are restored to their normal condition and position, the lights in the lamp circuit burn brightly and the link-armature is held clear of the pole shoe by the spring. If the additional light has been removed from the circuit this condition will continue; if, however, the extra lead is still there, the electro-magnet will once more retract the latch, the switch will be opened and the lights be dimmed. This action will continue until the load is reduced to that contracted for, as provided for by the spring adjustment, so that there will be a series of light pulsations alternating with intervals of dimness. If the contract is altered so that more or less lights or other units of consumption are stipulated for, the monitor is set for the new conditions by adjusting the spring l so that it just overcomes the attraction of the electro-magnet when the full current is on.

The monitor will be inclosed in any suit-

able case and locked or sealed to prevent tampering therewith, and will be accessible to the supplier only.

While I have shown and described my invention as embodied in the form which I at present consider best adapted to carry out its objects, it will be understood that it is capable of modifications, and that I do not desire to be limited in the interpretation of the claims except as may be necessitated by the state of the prior art.

Having now fully described my invention and set forth the method of operation thereof as well as its application and advantages, I declare that what I particularly claim and desire to have secured unto me by Letters Patent is:

1. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, electrically controlled mechanism set in action by a decrease in circuit resistance, to open the switch and shift the entire current through the resistance, a shunt circuit closed an interval after said opening, a solenoid in said shunt circuit, a gravity core in said solenoid, means for supporting said core in the solenoid while the resistance in the circuit is at normal, and a connection between said core and the switch to hold the switch closed so long as the core is supported.
2. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a solenoid, a gravity core in said solenoid, means for supporting the core in the solenoid while the resistance in the circuit is at normal, means set in action electrically by a decrease of such resistance to withdraw the support from the core and permit the latter to fall, a connection between the switch and the core whereby the latter opens the switch in its fall, to shift the entire current through the resistance, and a shunt circuit embracing said solenoid and closed an interval after the opening of the switch, to energize the solenoid.
3. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a solenoid, a gravity core in said solenoid, means for supporting the core in the solenoid while the resistance in the circuit is at normal, means set in action electrically by a decrease of said resistance, to withdraw the support from the core and let it fall, a connection between the switch and the core whereby the switch

is opened by the latter in its fall, to shift the entire current through the resistance, and closed by said core in its rise, after an interval, as the core is sucked in by the solenoid, and a shunt circuit embracing said solenoid and closed an interval after the opening of the switch, to energize the solenoid.

4. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a solenoid, a gravity core in said solenoid, means for supporting the core in the solenoid while the resistance in the circuit is at normal, means set in action electrically by a decrease in such resistance, to withdraw the support from the core and permit it to fall, a connection between the switch and the core whereby the switch is opened by the latter in its fall, to shift the entire current through the resistance, a shunt circuit embracing the solenoid and normally open, and a circuit closer struck by the switch as it is thrown open and closing the shunt circuit to energize the solenoid to lift the core.

5. An electric work circuit regulating monitor, comprising a high-resistance circuit permanently connected, and a low-resistance switch circuit normally closed, between terminals in a branch circuit furnishing current for the work, electrically-controlled mechanism set in action by an increase of current and operating to open the switch and shift the entire current through the high resistance, a shunt circuit closed at an interval after the opening of the switch, a solenoid in said shunt circuit, a permanent electrical connection between one main and one end of the solenoid winding, a conductor permanently connected to the other end of the solenoid winding and to a contact carried by the switch, another contact electrically connected to the other main which the contact carried by the switch strikes to close the shunt circuit, a core for said solenoid, and a connection between said core and the switch whereby the core acts to restore the switch as the shunt circuit is closed.

6. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a shunt circuit embracing a solenoid, a gravity core in said solenoid connected with the switch to open the latter as the core falls, thereby shifting the entire current through the resistance, means for normally supporting the core, means set in action by a decrease in circuit resistance and operating to withdraw the support from

beneath the core, and a brake for the core determining the speed and period of its descent.

7. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a shunt circuit embracing a solenoid, a gravity core in said solenoid connected with the switch to open the latter as the core falls, thereby shifting the entire current through the resistance, means for normally supporting the core, means set in action by a decrease in circuit resistance and operating to disengage the support from the core and let it fall, a brake for the core determining the speed and period of its descent, and means for setting said brake to prolong or reduce such period.

8. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals of the branch circuit furnishing current for the work, a shunt circuit embracing a solenoid, a gravity core in said solenoid connected with the switch to open the latter as the core falls, thereby shifting the entire current through the resistance, a latch engaging said core to support it in elevated position, and means operated by a drop in circuit resistance, for withdrawing said latch.

9. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a shunt circuit embracing a solenoid, a gravity core in said solenoid connected with the switch to open the latter as the core falls, thereby shifting the entire current through the resistance, a latch engaging said core to support it in elevated position, means operated by a drop in circuit resistance for withdrawing said latch and permitting the core to fall, and means for restoring said latch to engagement upon the rising of the core.

10. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a shunt circuit embracing a solenoid, a gravity core in said solenoid connected with the switch to open the latter as the core falls, thereby shifting the entire current through the resistance, a latch engaging said core to support it in elevated position, an electro-magnet in the line, a hinged armature therefor, connected to the latch and urging it out of engagement, and a spring acting upon the latch with just

sufficient force to overcome the normal pull of the armature and hold it in engagement.

11. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a shunt circuit embracing a solenoid, a gravity core in said solenoid connected with the switch to open the latter as the core falls, thereby shifting the entire current through the resistance, a spring impelled latch engaging said core to support it in elevated position, an electro-magnet in the line, a hinged armature therefor, connected to the latch and urging it out of engagement, and means for adjusting the tension of the spring to compensate for increase or decrease of consuming units.

12. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit furnishing current for the work, a shunt circuit embracing a solenoid, a gravity core in said solenoid connected with the switch to open the latter as the core falls, thereby shifting the entire current through the resistance, a latch engaging said core to support it in elevated position, an electro-magnet in the line, a hinged armature therefor, connected to the latch and urging it out of engagement, a spring coiled about the shank of the latch and urging it into engagement with just sufficient force to overcome the normal pull of the armature, whereby the additional energy of the magnet accompanying a drop in line resistance will cause said armature to disengage the latch, and a nut threaded upon the shank of the latch and capable of being set up against the spring to enhance its tension, or withdrawn to reduce it, to compensate for increase or decrease in number of consuming units.

13. An electric work circuit regulating monitor comprising a resistance circuit permanently connected, and a low resistance switch circuit normally closed, between terminals in the branch circuit which furnishes current for the work, a shunt circuit, a solenoid in said shunt circuit, a solenoid core dropping by gravity and connected to the switch to open it a spring-retained detent for said switch when opened, forming one terminal of the shunt circuit and closing it through said switch, and a disengaging pin for said detent, against which it is lifted by the switch as the core is sucked in by the energization of the solenoid following the closing of the shunt circuit, whereby the circuit is broken by the closing of the switch.

14. A combination of the spring bridge switch, stop posts therefor against which it is held by the core when the latter is out

vated, a detent, its casing, a coiled spring within said casing, acting against said detent to hold it withdrawn therein, a shunt circuit having contacts, one connected to said detent and the other carried by but insulated from the switch, a solenoid therein, a solenoid core connected to the switch,

means for holding said core normally elevated, means for releasing it and the switch, and a disengaging pin for the detent.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."