(No Model.)

W. B. HARVEY.

ELECTRIC CIRCUIT PROTECTOR.

No. 399,400. Patented Mar. 12, 1889.

Fig. 1.

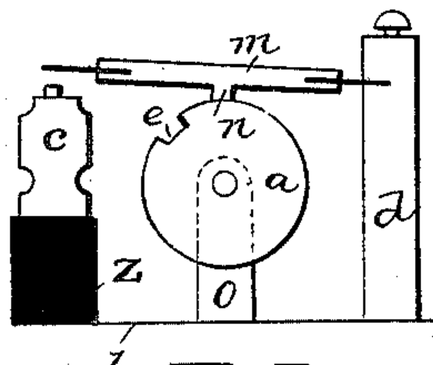


Fig. 2.

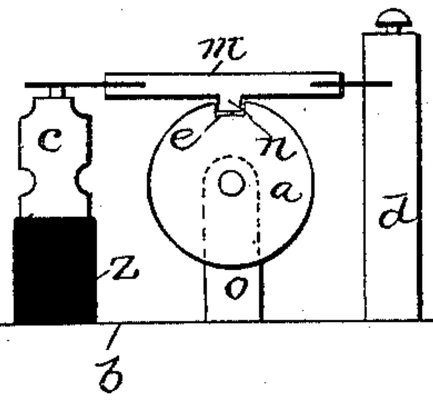


Fig. 3.

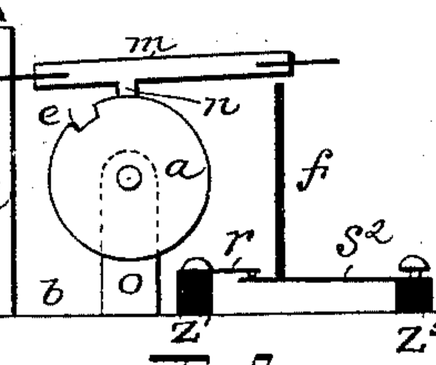


Fig. 4.

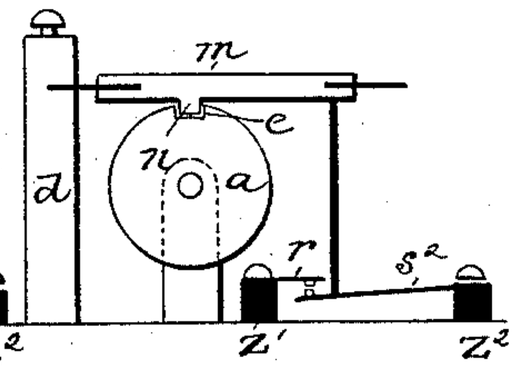


Fig. 5.

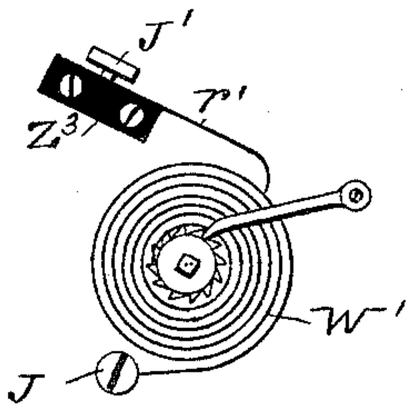


Fig. 6.

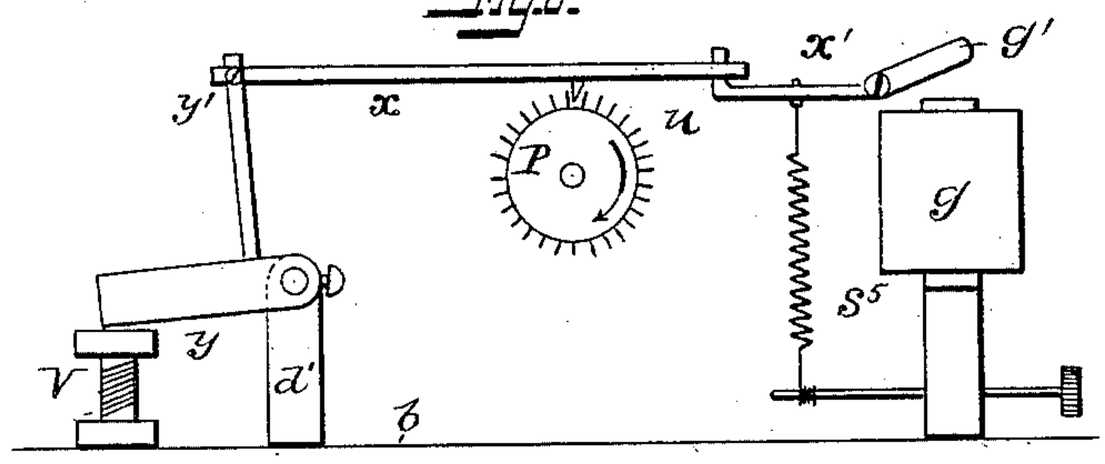


Fig. 7.

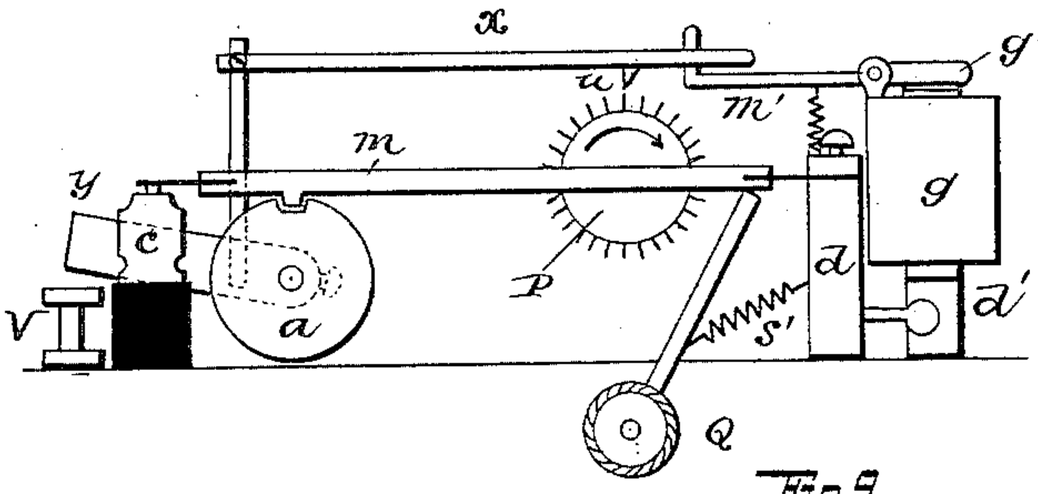


Fig. 8.

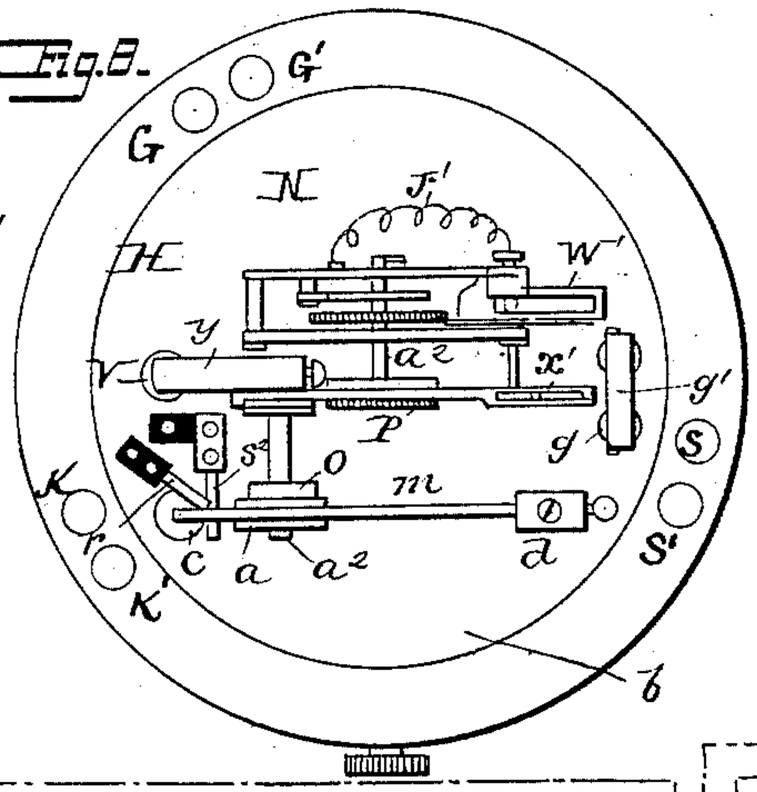
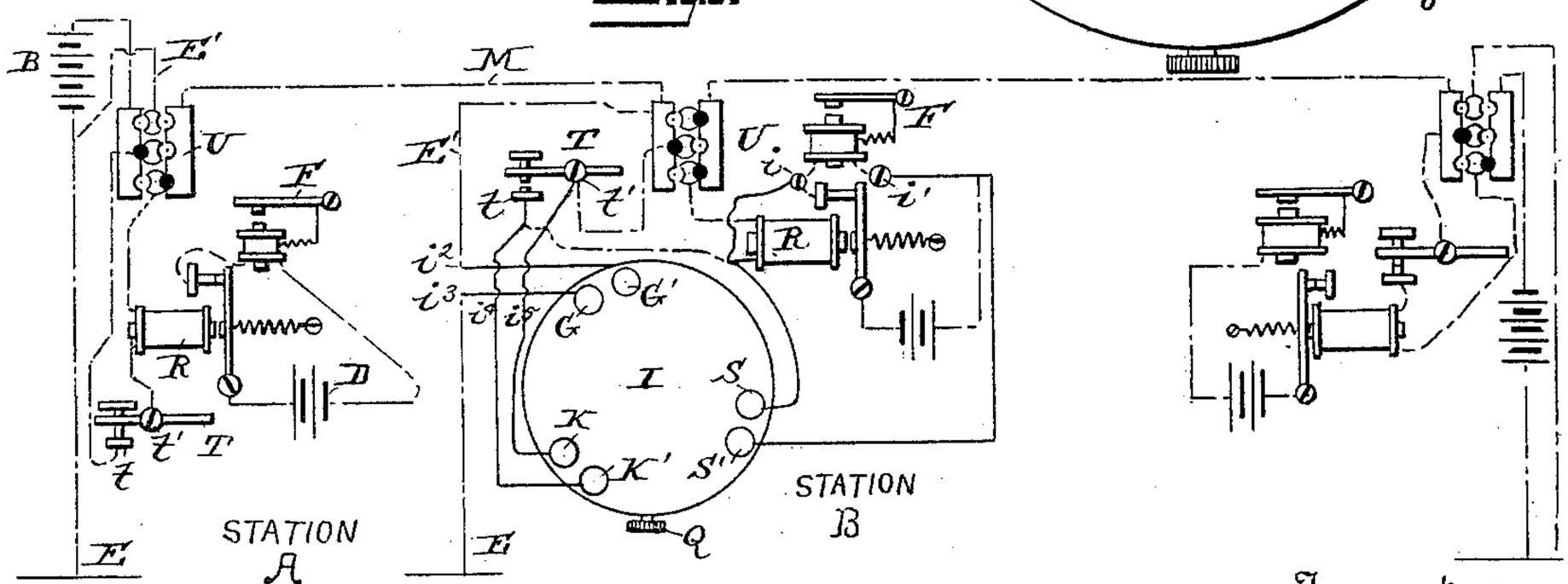


Fig. 9.



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UNITED STATES PATENT OFFICE.

WIRT BROWER HARVEY, OF MEMPHIS, TENNESSEE.

ELECTRIC-CIRCUIT PROTECTOR.

SPECIFICATION forming part of Letters Patent No. 399,400, dated March 12, 1889.

Application filed February 28, 1888. Serial No. 265,644. (No model.)

To all whom it may concern:

Be it known that I, WIRT BROWER HARVEY, a citizen of the United States, residing at Memphis, in the county of Shelby and State of Tennessee, have made a new and useful invention in Apparatus for Protecting Telegraphic and other Electrical Circuits, of which the following is a specification.

My invention relates particularly to that class of devices designed to secure continuity of circuit on telegraph and analogous electric lines which run through several stations where individual operators are located, who, through carelessness, often leave their transmitting-keys open; and its object is to overcome this annoyance, and also to break any local earth at any of a series of stations, or, in other words, to so operate as to automatically preserve a continuity of circuit either through the station where a key is open or to break an earth-circuit left on through neglect, thereby avoiding all possibility of annoyance due to a broken or earthed line when these accidents happen through the carelessness of operators. I accomplish these objects by the use of the mechanism hereinafter described, but particularly pointed out in the claims which follow this specification.

My invention will be fully understood by referring to the accompanying drawings which illustrate it, and in which Figures 1, 2, 3, and 4 are side elevational views of parts of my automatic switch mechanism, showing these parts in different positions. Fig. 5 is a side elevation of an apparatus used in connection with the automatic switch apparatus to indicate when the driving mechanism is nearly or quite run down. Fig. 6 is a side elevation of the electro-magnetic apparatus and connections which control the action of the switch mechanism. Fig. 7 is a similar view showing in addition the switch mechanism controlled thereby. Fig. 8 is a plan view of the apparatus entire, adapted for use on any telegraph or analogous line. Fig. 9 shows a Morse line and instruments with three stations and the apparatus shown in Fig. 8 in operative position at the middle station only. In Figs. 1 and 2 the switch apparatus is adapted for use at end stations, while Figs. 3 and 4 show the additional feature of each circuit switch mechanism to avoid the trouble due to a local ground or earth, as will be fully explained in the description of the operation of my improved apparatus.

N is a clock mechanism of well-known pattern, driven either by weight or a spring, *w*, as shown, said clock mechanism with the entire switch-connections being affixed to a base, H, similar to those used in ordinary relay-instruments, and provided with binding-posts G G′, K K′, and S S′. This clock mechanism operates a shaft, a^2, carrying a ratchet-wheel, P, adapted to rotate in the direction of the arrow shown in Figs. 6 and 7.

a is a notched drum or disk carried by a shaft pivoted or journaled in two supports on the base H, and having a weighted arm, Y, adapted to rotate it to the left, as seen at Fig. 7.

m is a conducting switch-arm connected by a flat spring at one end to the upright conducting-post *d* in electrical contact with the metal base of the instrument, its free end being provided with a spring-contact adapted to make and break contact with the metal post *c*, insulated from the metal base. This post *c* is connected by a wire to the binding-post K on the wooden portions of the base, and it in turn is connected to the key T by wire i^4. (See Fig. 9.) The post K′ is electrically connected to the metal base, and hence to the metal post *d*. This post is also connected to the back-stop of the key at *l* by wire i^5. (See Fig. 9.)

r and s^2 are two springs, which are adapted to contact with each other when the insulated pin *f*, carried by the arm *m*, is lifted, as shown in Fig. 3, and to break said contact when the pin is in its lower position, as shown in Fig. 4. The spring *r* is electrically connected with the binding-post G, which in turn is connected by wire E′ to the earth-plug of switch-board M, while S^2 is similarly connected to binding-post G′ and to the earth at E by wire i^3. The binding-post K is also connected by a wire, J′, (see Fig. 5,) to an insulated spring, *r*′, adapted to contact with the clock-spring *w*

when run down, and it in turn is connected by a wire, J, to the metal base of the instrument, the function of this device being to shunt the operator's key T when the clock has run down, and thereby prevent the operator from operating it till the clock mechanism is again wound up.

g is an electro-magnet connected in a derived circuit or shunt from the sounder-battery D, and adapted to hold its armature *g'* in the position shown in Fig. 7 so long as the main-line circuit is closed. This armature has a retractile spring, s^5, provided with the usual adjustment, and is adapted when drawn down by the magnet *g* to lift the free end of the pawl-lever *x*, pivoted to the arm *y'*, borne by the shaft which carries the weighted lever *y*. The lever *x* has a pawl or hook, *u*, adapted to take in the ratchet-teeth of wheel *p* as it rotates to the right. (See Fig. 6.)

V is an adjustment-screw for regulating the throw of levers Y Y'.

Q is a hand-lever for lifting the switch-lever *m* and allowing the weighted lever *y* to rotate disk *a*, and thereby remove the notched portion from beneath the projecting pin, as shown in Figs. 1 and 3.

Fig. 9 shows a three-station Morse line with my improved automatic switching mechanism in operative connection at the middle station, B, M being the main line, B B the main batteries, and D D D the local batteries, each station having the usual Morse keys, sounders, and switch-board connections. In this figure I will suppose that the main circuit from main batteries B B is in normal condition passing through all of the keys and relays at the several stations. I will therefore describe the operation of my improved apparatus under all the conditions which are usually liable to occur.

As shown, all of the operators are in condition to interchange signals. First, suppose operator at station B to have left his key open. In consequence there is no current on the line and all the relay-armatures will be on their back-stops; hence all of the sounder-magnet circuits will be broken.

Inasmuch as the switch apparatus at station B is controlled by a derived circuit from the local battery, the circuit of magnet *g* will be broken and its armature will be in the position shown in Fig. 6, thereby allowing the pawl or hook *u* to take behind one of the teeth of wheel P. The notch *e* of disk *a* being normally in the position shown in Fig. 1 or 3, the pin *n* of the contact-lever *m* rides upon the face of said disk, and the circuit between *c* and *m* is broken. After a predetermined time the clock mechanism, continuing its action through wheel *p*, pawl *u*, and levers *x* and *y* upon the shaft which carries notched disk *a* and weighted lever *y*, causes said disk to assume the position shown in Fig. 7, thereby allowing the pin *n* on lever *m* to fall into the notch *e* of said disk and the free end of lever *m* to come into electrical contact with the metal post *c*. The main-line current is then closed through the relays at the distant station, and also through that of station B, as follows, (see Fig. 9:) entering from station A by switch-board U to plug connected to key T at *t'*, thence by wire i^5 to binding-post K, thence by wire (not shown) to insulated post *c* and free end of lever *m* resting thereon, through said lever to post *d* and metal base to binding-post K' by wire, (not shown,) thence by wire i^4 to lower back contact of key T through wire shown in dotted lines, through relay R, and finally to plug and switch-board U and out to station C. This energizes relay R and closes the local circuit of sounder-battery D through both the sounder-magnet and the protector-magnet *g*, thereby restoring the parts to the position shown in Fig. 7. The operator at station B cannot operate his key now effectively until he has released the weighted lever *y* and broken circuit between *c* and *m*, which can be done by turning the thumb-lever Q to the left against the tension of spring S', thereby lifting lever *m* and releasing disk *a*, which rotates to the position shown in Figs. 1 and 3. Now suppose the operator at station B has left his ground-switch on, as shown by the plug at the upper right-hand side of the switch-board. Under this supposition station C is cut off from both A and B, and only A and B can communicate, station C being earthed around the relay of station B by earth-wire E', all the keys now being closed. This earth-circuit from station C is as follows: from main line to switch-board U and plug by earth-wire E' to binding-post G, insulated from the frame; thence by wire (not shown) to spring-contacts *r* and s^2, both insulated from the frame; thence by wire (not shown) to binding-post G', insulated from the frame, and finally to earth by wire i^3. The circuit from that portion of main battery B at station A now actuates the relays R at stations A and B, so that the operators located at these stations can interchange signals to the exclusion of the operator at station C. If now station A desires to call C, he cannot do it, and should the operator at B be out A can only await his return, should the line be unprovided with any apparatus for breaking the earth at B automatically. With my apparatus the operator at A simply leaves his key open. This breaks the circuit through relay R at station B, as before, and demagnetizes magnet *g* of the circuit-interrupter, thus allowing the clock mechanism to advance the notched disk *a* as before until the pin *n* drops in notch *e*. When this occurs, the free end of lever *m*, carrying the insulated pin *f*, drops, and the latter bears upon spring s^2, breaking circuit between it and *r*. (See Fig. 4.) The earth is now broken at station B, and both main-line batteries B B are in circuit between stations A, B, and C and all the relays in action. On returning to his office the operator at B cannot operate his

key T to call stations A and B, because it is shunted through the circuit shifter or protector, as before explained. He will then take hold of lever Q and restore lever *m* to its normal position, at the same time winding the clock mechanism up by a key in the usual manner should it be run down. Should the clock mechanism be run down, his key will also be shunted through binding-post K, wire J′, flat spring *r*′, clock-spring W, (see Fig. 5,) wire J, metal frame of instrument, and binding-post K′.

I am aware that it is old to provide automatic switches for closing the circuit at the key after an operator has ceased to transmit a message, and I therefore make no claim to this feature, broadly; but

What I do claim, and desire to secure by Letters Patent of the United States, is—

1. A circuit-protector for telegraphic and analogous electrical circuits, consisting of a clock mechanism, in combination with an electro-magnet controlling its operation and a normally-open shunt around the key, including in its circuit a switch controlled by said clock mechanism, as described, whereby the key will be automatically shunted when the main line is left open at any point, substantially as described.

2. A circuit-protector for telegraphic or analogous circuits, consisting of a normally-open shunt connected to the front and back contacts of the operator's key, in combination with a clock mechanism having a switch mechanism for closing said shunt when set in motion, said clock mechanism being held out of action by an electro-magnet so long as the line remains closed, substantially as described.

3. A circuit-protector for telegraphic and analogous circuits, consisting of a normally-open shunt around the point to be protected, with switch mechanism for closing the shunt, and a clock mechanism held out of action with the switch for controlling the operation of the switch mechanism, substantially as described.

4. A circuit-protector for keeping a circuit closed at a given point, consisting of a normally-open shunt around the point to be protected, in combination with a switch connected to a mechanical motor for operating it, and an electro-magnet for connecting said motor with the switch and permitting the switch to automatically close the shunt, said electro-magnet being under the control of the operator at both the home and distant stations, substantially as described.

5. A circuit-protector for keeping a telegraphic or analogous circuit closed at a given point, consisting of a normally-open shunt around the point to be protected, in combination with a switch for closing the shunt and an electro-magnet under the control of the main-line current for regulating the operation of the switch, substantially as described.

6. A circuit-protector for breaking an earth-circuit in a telegraphic or analogous circuit, consisting of an earth-wire having a circuit-breaker normally closed between the switch-board and the earth, in combination with a mechanical motor for breaking said earth-wire at said point and an electro-magnet for connecting said motor with the switch when de-energized, whereby when the line is grounded by an operator at a station said ground will after a predetermined time be automatically broken, substantially as described.

7. A circuit-protector for telegraphic or analogous circuits, consisting of a normally-open shunt around the point to be protected, in combination with a switch for closing said shunt, a motor for operating said switch, and an electro-magnet for holding said motor normally out of operative connection with the switch, whereby, when the circuit is left open at the point to be protected for a predetermined time, said shunt will be automatically closed and the main circuit maintained intact, substantially as described.

8. A circuit-protector for telegraphic or analogous circuits, consisting of the following combination of parts: a normally-open shunt around the point to be protected, a switch for closing said shunt, a spring-impelled motor for actuating said switch, an electro-magnet for holding said motor out of operative connection with the switch, and a second normally-open shunt about the same point, said second shunt being open at a point between a fixed contact-point and the spring which impels the motor, substantially as described.

9. A circuit-protector for telegraphic or analogous circuits, consisting of a normally-open shunt about the point to be protected, in combination with a spring-impelled motor and an electro-magnet holding said motor out of operative connection with the switch, said shunt, when closed, including in its circuit a fixed point and the spring of the motor, the parts being arranged as shown, so that when the motor is wound up the shunt is open, and when run down it is closed, substantially as described.

10. A protector for telegraphic or analogous circuits, consisting of a shunt about the point to be protected, said shunt being open when the circuit is closed through said point, in combination with a switch for closing said shunt, a mechanical motor for actuating said switch, and an electro-magnet located in a derived circuit from the sounder or local battery for holding said motor out of action with the switch, whereby, after the main circuit has remained open a predetermined time, the shunt is automatically closed about said point, substantially as described.

11. A circuit-protector for telegraphic or analogous circuits, consisting of a normally-open shunt around the point to be protected, in combination with a switch and spring-impelled motor for closing said shunt, and a second shunt normally open between the

spring of the motor and a fixed point, with an electro-magnet for holding said motor out of operative connection with the switch, whereby the point to be protected is shunted by the first shunt after the circuit has been left open a predetermined time and again permanently shunted by the second shunt until the motor is wound up, substantially as described.

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Witnesses:
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